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The Minuteman Education Program (MMEP) is expected to cost SAC 2.2 million dollars during the 1980 fiscal year. Due to inflationary pressures and limited military budgets, the cost of the program as currently structured may become prohibitive. The primary objective of this research is the investigation and evaluation of factors that would impact on the use of teleteach technologies in the MMEP. The purpose of this study was to: (1) identify state-of-the-art equipment available for use in a teleteach program; (2) identify the costs of the available equipment, compare these costs to those of the current MMEP; (3) ascertain if a teleteach can be more responsive to the United States Air Force's (USAF) Advanced Academic Degree needs; and (4) identify the impact of teleteach on the academic standards required by AFIT and MMEP. The authors concluded that: (1) there is a variety of teleteach equipment available, (2) the cost of the MMEP conducted by teleteach technology can substantially reduce the cost of the current MMEP, (3) teleteach in the MMEP can be more responsive to the USAF advanced academic degree needs, and (4) teleteach could be used for some degree programs without adversely impacting academic standards.

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THE APPLICABILITY OF TELETEACH TECHNOLOGIES TO THE MINUTEMAN EDUCATION PROGRAM

A Thesis

Presented to the faculty of the School of Systems and Logistics

of the Air Force Institute of Technology

Air University

In Partial Fulfillment of the Requirements for the

Degree of Master of Science in Logistics Management

By

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June 1980

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has been accepted by the undersigned on behalf of the faculty of the School of Systems and Logistics in partial fulfillment of the requirements for the degrees of

MASTER OF SCIENCE IN LOGISTICS MANAGEMENT
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(Captain Paul V. Lewis)

MASTER OF SCIENCE IN LOGISTICS MANAGEMENT
(MAINTENANCE MAJOR)
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DATE: 9 June 1980

Michael B McCormick
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CHAPTER I

INTRODUCTION

The Minuteman Weapon System

The Minuteman weapon system is a solid fuel intercontinental ballistic missile (ICBM) capable of delivering multiple nuclear warheads with pinpoint accuracy. The Minuteman missiles are maintained and supported by the Strategic Air Command (SAC). They are located at six SAC bases. Figure 1 shows the location of these bases (51:40).

ICBMs are one leg of the United States' triad of strategic weapons. This triad, which also includes manned bombers and submarine launched ballistic missiles, serves as a powerful deterrent against nuclear war. To achieve this deterrent capability the majority of these weapons maintain a constant alert rate. On a day-to-day basis, however, only the ICBMs maintain an alert rate that approaches 100 percent. ICBMs stand ready for wartime execution on a twenty-four-hour-a-day basis. The daily operation and wartime execution of the Minuteman ICBMs are the responsibility of two-officer launch crews (51:2).

The Minuteman Launch Control Centers (LCC) are manned around the clock by a two-officer crew, responsible for a flight of ten Minuteman missiles. This responsibility

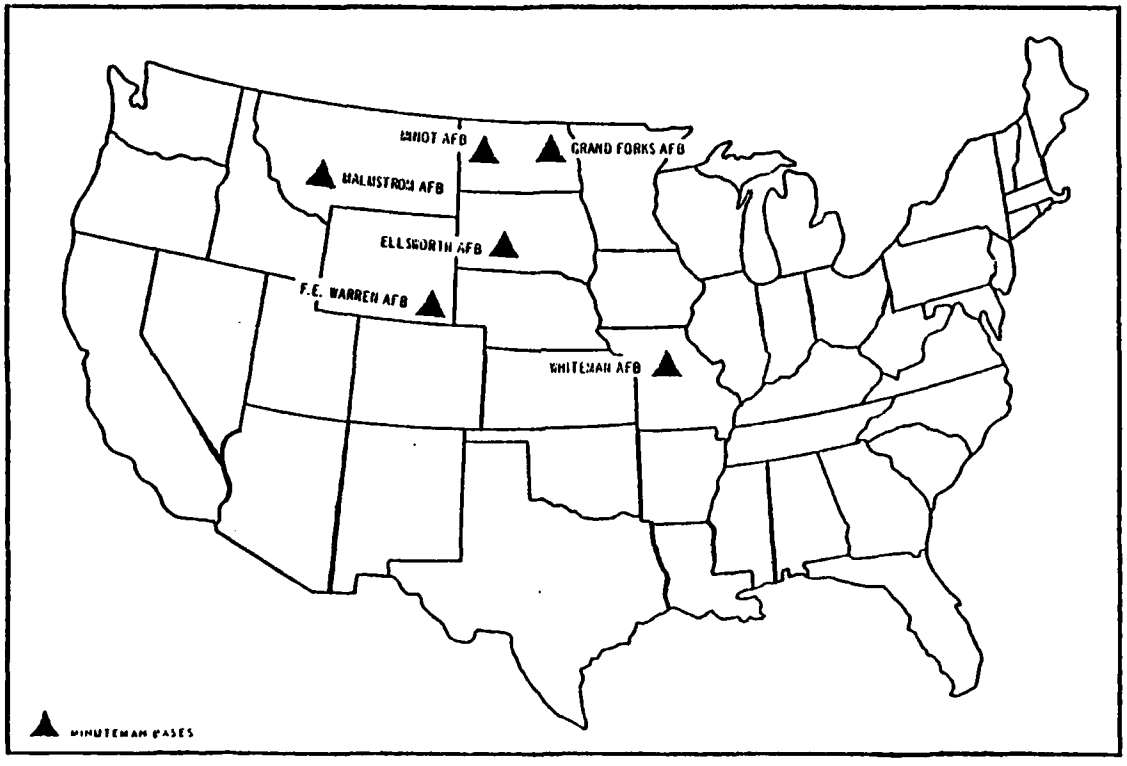

Fig. 1. Location of Minuteman Bases [51:20]

can expand to a squadron of fifty missiles during abnormal conditions. The responsibilities of the combat crew members include the security of the deployed weapons, the safe operation of the weapon system, the supervision of maintenance activites at both the LCC and remote missile launch facilities (52:41), the control of top secret documents maintained at the LCC, and the ultimate launch, under Presidential order, of ICBMs (52:26). While crew members shoulder many critical responsibilities in the nation's defense, the day-to-day routine is much different (9:7).

The daily routine requires little active work. A series of short tests must be conducted daily. The procedures for these tests are highly structured and are specified in step-by-step checklists provided in the technical orders. Daily the crew must inventory the classified material at the LCC. The remainder of a twenty-four-hour alert tour consists of supervising maintenance activity and the passive monitoring of computer controlled indicators (54:26).

The heavy responsibilities carried by the two crew members require that they be highly intelligent, mature, and stable individuals. On the other hand, the relative simple daily routine and the high reliability of the Minuteman weapon system results in an environment that is intrinsically undesirable (9:7). Consequently, SAC has taken

several steps to motivate officers to enter and remain in the missile launch officer career field.

The Minuteman Education Program

In 1963 SAC began providing Minuteman missile launch officers the opportunity to earn a graduate degree while assigned to missile duty. Launch officers may attend classes scheduled, by their Strategic Missile Wing (SMW), as part of their normal duty and they may study while on alert duty at the LCC. This opportunity is provided through the Minuteman Education Program (MMEP).

> The broad objective of the MMEP is to attract volunteers to the SAC Minuteman missile combat crew force by offering a graduate education at no charge to the crew members [53:p.2-1].

The MMEP is conducted at the six Minuteman bases. The MMEP is available through the efforts of SAC, the Air Force Institute of Technology (AFIT), and five civilian universities under contract to provide the educational programs. Table 1 summarizes the current MMEP (53:p.2-2).

The MMEP at each base is managed by an AFIT detachment. The detachment commander monitors compliance with the MMEP contract, counsels students, monitors student progress, and coordinates between the university and military representatives. Collocated at each detachment is a branch of the contract university's campus, with faculty, library, classrooms, and academic support equipment. The universities also provide support personnel, such as

TABLE 1

CURRENT MMEP LOCATIONS

Air Force Base	Degree	University
Malmstrom AFB Great Falls, MT	MBA	U of Montana Missoula, MT
Ellsworth AFB Rapid City, SD	MBA**	U of South Dakota Vermillon, SD
Minot AFB Minot, ND	MBA	U of North Dakota Grand Forks, ND
Whiteman AFB Knob Noster, MO	MBA*	U of Missouri Columbus, MO
F. E. Warren AFB Cheyenne, WY	MBA*	U of Wyoming Cheyenne, WY
Grand Forks AFB Grand Forks, ND	MBA	U of North Dakota Grand Forks, ND

*A Computer Science option is available.

**A MS in Engineering Management is also available.

program administrators, secretaries, and librarians (53: p.2-2). Currently, all contract universities offer accredited instruction leading to a Master's Degree in Business Administration.

The MMEP provides missile launch officers an opportunity to study management principles at the graduate level thus providing a vehicle with which to offset the many hours of potential boredom of missile alert duty. This opportunity serves as an inducement for officers to enter the missile combat crew force. It also develops officers

that are more capable of filling future middle and senior management positions within the Air Force (51:8).

Problem Statement

The MMEP is expected to cost SAC 2.2 million dollars during the 1980 fiscal year. This cost includes salaries, wages, and benefits for university employees, library acquisitions, computer support, and other direct costs (53:p.3-14). This figure is expected to increase 4 to 6 percent during each of the next three years. Since the MMEP is funded through SAC's operations and maintenance budget, it competes for highly demanded dollars (9:13). To prevent the cost of MMEP from becoming prohibitive, either through cost increases or reduced dollars, alternatives for conducting the program at reduced costs must be found. The viability of teleteach technologies (electronic audio-visual transmission of classroom instruction from a central sending station to multiple remote receiving stations) as an alternative to the present MMEP needs to be evaluated.

Research Objectives

The primary objective of this research is the investigation and evaluation of factors that would impact on the use of teleteach technologies in the MMEP. The sub-objectives associated with the factors of interest are as follows:

1. Identify state-of-the art equipment available for use in a teleteach program.

2. Identify the costs of the available equipment. Compare these costs to those of the current MMEP.

3. Ascertain if a teleteach can be more responsive to the United States Air Force's (USAF) Advanced Academic Degree needs.

4. Identify the impact of teleteach on the academic standards required by AFIT and MMEP.

Research Questions

To achieve the stated objectives, the following questions will be addressed.

1. What equipment is currently available for use in a teleteach MMEP?

2. What is the cost of the available equipment?

3. Is there an economic advantage to a teleteach MMEP?

4. Can a teleteach MMEP more suitably meet the USAF's Advanced Academic Degree needs?

5. Can teleteach techniques provide accredited graduate level education?

Justification

The issue of the MMEP cost was addressed by the Deputy Chief of Staff for Personnel, Fifteenth Air Force in 1976. He stated:

> MMEP represents a direct SAC annual expenditure of almost two million dollars. While I believe the program to be beneficial to our missile combat crew member, I nevertheless believe there are substantial savings that can be realized. . . . Since its inception in mid 1962, the MMEP operations has involved SAC, the Air University, and AFIT. . . . While this management "TRIAD" is workable, there are a number of distinct financial and managerial advantages to be realized through a single operational concept [9:13].

This thesis is concerned with the feasibility of changing the MMEP structure to realize some "financial and managerial advantages."

CHAPTER II

LITERATURE REVIEW

Introduction

This chapter begins with the definition of teleteach that is used throughout the following chapters. The remainder of the literature review focuses on three primary areas: (1) past studies of the MMEP, (2) Air Force needs in graduate education, and (3) past teleteach studies and teleteach technologies.

Teleteach Defined

Educators do not agree on a common definition of instructional technology. The term instructional technology, usually refers to the hardware used to store, transmit, and present the material the student uses to learn the objectives of the instruction. The term is also used to refer to the design process used in the development of the instructional material. However, many instructors, at all levels, tend to associate the word technology with only the hardware (42:660-661). This thesis is concerned with the hardware aspect of instructional technology. The development of the various lesson plans to be used with any specific technology is not considered.

This research further narrowed the view of instructional technology. The focus was on teleteach technologies. Teleteach is a process of transmitting instruction from a transmitting station (instructor present) to a remote receiving station (no instructor present) using a combination of telephones (in the conference mode), audio (both live and tape), video tape, 35 mm slides, viewgraphs, printed materials, electronic chalkboards, and audio-visual television systems (23:2).

Past MMEP Studies

Past studies indicate that, as a recruiting incentive, the MMEP has proved to be somewhat less than totally effective. However, for many young men the MMEP is providing the opportunity to enhance their educational standing while, at the same time, performing an important role in the nation's defense (11:67). A study of the MMEP conducted by Paul Francis Murphy of Syracuse University, found the MMEP to have a significant positive impact on the need satisfaction of those officers enrolled in the MMEP. The real problem concerning job satisfaction with the missile launch officer is not the MMEP, but missile duty itself. Thus for a number of officers, the MMEP does provide a high degree of self satisfaction, which is not obtainable from their basic job (29:94).

There have been several studies conducted by the Air Force and SAC whose primary object was the evaluation of the MMEP. In 1964 HQ USAF directed the discontinuation of the MMEP. However, after a lengthy study, SAC argued for the continuation of the MMEP based on the costs already incurred, the graduate educational needs of the USAF, and the contribution to crew member satisfaction. HQ USAF reversed its decision and MMEP was continued (9:11).

In 1967, SAC became concerned about the low (27 percent) participation rate in the MMEP. Consequently, efforts were made to maintain MMEP as a viable program and local commanders were encouraged to increase participation rates to 60 percent. Duffin views this as an example of goal displacement:

> Curiously, the MMEP was initiated in 1962 as an incentive to missile officers, but by 1967-71, the means (MMEP) and the goal (missile duty) had reversed orientation so that missile duty became the means by which participation in MMEP, the goal was attained [9:12].

In 1976, the Deputy Chief of Staff for Personnel, Fifteenth Air Force addressed the issue of costs of maintaining the MMEP. His basic theme was that the MMEP represents a direct SAC annual expenditure of two million dollars and, while the program was believed to be beneficial to the missile combat crew member, it needed to be examined to determine if savings could be realized in the administration of the program. In 1977, the USAF conducted a study to determine the current validity of expending two

million dollars annually to support the MMEP (9:12). This study, conducted by an ad hoc committee of Fifteenth Air Force Staff officers, concluded that SAC no longer had a valid requirement for the MMEP. The majority of the committee recommended that the program be eliminated. Minority opinions, however, recommended that the program be continued. Consequently, the committee proposed several options for decision makers to consider. The committee acknowledged that the MMEP in the future may be exactly the same, eliminated entirely or changed in some form (9:88).

Air Force Advanced Academic Needs

The benefits of management training are considerable for both the USAF and the student. AFR 213-1 states that each officer should have educational background at least to the baccalaureate level including, when possible, specific fields of study appropriate to the Air Force specialty and that opportunities for graduate study leading at least to masters degree completion should be available to academically qualified personnel (55:7). Further, the USAF has identified certain job specialties that require advanced knowledge at a level attainable only through graduate education.

One of the goals of the MMEP is to meet educational requirements of the USAF. As of 1977, the USAF has validated 8,500 positions requiring master's degrees.

Although there are presently over 25,000 USAF officers holding master's degrees, there is a projected shortage of 1,000 officers with specialty degrees. Table 2 summarizes the projected shortages in several academic specialties (9:83).

TABLE 2

PROJECTED SHORTAGES OF SPECIALTY DEGREES

Academic Specialty	Validated Advanced Academic Degree (Master's Degree)	5-Year Projected Shortage from 1977
Data Processing	393	63
Telecommunications	192	89
Special Facilities Mgt*	260	177
Engineering Mgt	377	105
Logistics Mgt	876	199
Public Relations	201	91
Electronic Engineering	777	61
Criminology	316	218
Totals	3392	1003

*NOTE: Specialty concerned with the allocation of human, financial, and physical resources in support of civil engineering activities

The MMEP is currently granting MBA degrees, a field which is already heavily oversupplied. This does not meet the specific advanced academic needs of the USAF. Business Administration specialties are being produced in excessive

number while the need for other academic specialties is not being met. Thus, it appears that changing the academic specialties of the MMEP would be a productive change for the USAF (9:82).

Teleteach Studies and Technologies

The scope of teleteach is defined by the phrase "electronically mediated instruction;" this covers almost all medium with sound recording. In particular, the purpose of teleteach is to improve education/instruction through appropriate use of educational modes such as telephone or television (40:69).

Telephone-Based Systems

The first reported instructional application of the telephone in the United States occurred in Iowa in 1939. With the aid of AT&T, Dr. Winterstein, the director of special education for Iowa, initiated a project to meet the needs of homebound and hospitalized students. Dr. Winterstein had intercom equipment installed in the student's homes. All class lectures were transmitted to the homebound and hospitalized students simultaneously. The homebound and hospitalized students were able to communicate with the teachers and students. Within two years of initiation of the project, more than 1,000 students benefitted by this new media of instruction (37:18).

The first college-level application of teleteach was conducted in November of 1947 by the College of Dentistry of the University of Illinois, Chicago Medical Campus. This application of telephone-based teleteach instruction consisted of transmitting six lectures to thirty dentists located in Scranton, Pennsylvania while the lecture was being given to fifty dentists in a classroom on the Chicago medical campus. The lectures were supplemented by slides at both locations. At that time the project was hailed as a "novel of educational service [37:19]."

In the 1950s, lectures by telephone began to receive attention from many American educators. Limited applications began to appear at all levels of educational programs, from elementary to the graduate level. During the early 50s a device known as "amplified telephone" came into use. This device was merely a telephone hooked into an amplifier with its associated speakers and microphones which enable the lectures to be conducted with larger groups at the remote sites (37:19).

One of the first major uses and evaluations of teleteach was initiated by Pennsylvania State University in 1954. This program was funded by a grant from the Fund for the Advancement of Education. Since then, numerous colleges and universities have successfully used teleteach instructions (16:16). However, many applications in the

1950s were one-shot projects and not implemented on a continuous basis.

During the 1960s teleteach (telephone based) gained popularity among elementary and secondary schools. Teleteaching was mainly developed in the school systems to meet the needs of homebound and hospitalized students. The New York and California school systems have been using this instructional method on a continuous basis. The program in both state school systems aims to continue the child's educational plan during his period of rehabilitation (37:19).

The equipment used in the California school system has some quite interesting features. The teacher sitting at a central console can dial any student on her roster on a selective basis or in a group. If needed, the teacher can isolate a communication link between her and a particular student so that their conversation cannot be heard by the rest of the group (37:19).

The New York City Board of Education conducted an experiment to determine the usefulness of the telephone in instructional communications. Homebound students were divided into two groups, one control and one experimental. The control group students were not allowed an opportunity for discussion with the speaker either during or after the lecture. The experimental group students were allowed to interact. At the conclusion of the experiment, the

experimental group showed significantly more positive orientation toward the teleteach mode of instruction (37:20).

In 1965, the University of Wisconsin developed a program of teleteach instruction to meet the continuing educational needs of medical doctors located throughout the state. This network has expanded to include the learning centers in courthouses, extension offices, and university campuses and centers. This system is basically a telephone network that takes the form of a huge party line. During 1974 through 1975 more than 25,000 students received instruction by this method (33:2).

Until 1966, the teleteach was limited to the lecture-discussion mode. In other words, oral presentations could not be complemented by written material as in a traditional classroom environment. In 1966, Cornell University combined telephone and television technologies in the Engineering School to teach a course in physical metallory to a group of research specialists located fifty-five miles away. The system transmitted oral lectures and hand-written material over telephone lines. However, this system had two major drawbacks; it was very expensive and secondly it did not have the ability for two-way graphic communication (37:20).

One of the most important accessories that has been developed to improve the effectiveness of telephone instructional communications was the electrowriter. The

electrowriter was developed in the early 1960s by the Victor Comptrometer Company of Chicago, Illinois. The electrowriter systems produced by Victor are referred to as VERB (Victor Electrowriter Remote Blackboard) (37:20).

The basic VERB system consists of a transmitter, a receiver, two data phones, and two telephone lines. The transmitter and receiver both have a writing area of eighteen square inches. As a pen moves on paper, varying tones are generated to represent the movement of the pen. As the tones are transmitted, a pen at the receiving end reproduces the movement of the original. This image is projected onto a larger screen by an attached overhead projector (37:20).

The invention of the electrowriter made it possible to use the telephone in instructional communications on a continuous basis. In the early 70s, many university extension divisions installed VERB systems to conduct educational activities in numerous fields of knowledge (37-20).

A study at West Virginia University revealed that achievement in VERB taught, remote extension classes was equal to or significantly greater than that in the on-campus classes. The University of Illinois, Division of University Extension, has used the VERB system since 1966 to teach graduate and undergraduate courses in engineering, mathematics, agriculture, education, and library science (37:21).

Recently, another telephone-based instructional system has been introduced. This device is referred to as the electronic blackboard. The electronic blackboard is a pressure-sensitive chalkwriting surface. Written material is converted into X-Y coordinates. These values are stored in a memory unit and then transmitted via telephone lines to local and remote receiving stations. At the receiving station, the data is "written" on a television screen. The electronic blackboard system basically uses a combination of telephones, in a conference mode, electronic blackboards and television monitors.

In 1979, the Air Force Institute of Technology, located at Wright-Patterson Air Force Base, initiated a teleteach instructional program in the School of Systems and Logistics' Profesional Continuing Education programs. The Teleteach Expanded Delivery System (TEDS) is based on the electronic blackboard. The instructors conduct class at Wright-Patterson Air Force Base and at the remote locations simultaneously. There are two originating classrooms, each connected to a different network. One network has five remote classrooms, while the other has four (49:1). It is estimated that during the first year of the operation of the TED, AFIT will realize a cost avoidance of over $260,000 (23:2).

Published studies of telephone-based instructional systems report numerous advantages offered by this mode of instruction. These are summarized below (37:21):

A. For Students:

1. The systems motivate students toward learning.

2. The systems seem to be ego satisfying for the students.

3. The systems provide ways to meet the needs of hospital and homebound students.

4. The systems allow communication between a teacher and a student when needed.

5. The systems allow immediate feedback.

6. Studies indicate that students learn as much or more using the telephone-based instructional systems when compared to other modes of instruction.

B. For Teachers:

1. The systems make faculty sharing by schools possible.

2. Utilization of the systems does not require any special training.

C. For Planners:

1. The systems utilize readily available telephone network.

2. The systems offer flexibility in planning and in scheduling.

3. The systems allow class offerings for a limited number of students in different remote locations simultaneously.

4. The systems offer quality instruction for students in remote rural areas.

5. The systems eliminate many travel costs for schools and save time for the instructor.

6. The systems may be used for administrative purposes when not in use for instructional classes

7. The systems may be less expensive when compared to other instructional media.

8. The telephone-based instructional system can be integrated into other instructional systems, such as computer assisted instructional systems.

While there are many advantages to telephone-based instructional systems, they are not entirely without criticism.

A study conducted by Lorne A. Parker of the University of Wisconsin, points out several disadvantages of the telephone-based instructional media. The failure of the students who are remotely separated to adopt a "group" attitude is given as a disadvantage. Students find it difficult to become actively involved in group discussions. Another disadvantage, which is characteristic of all audiences is the fact that students tend to not listen for a long period of time; this is compounded at the receiving

locations. Furthermore, students may miss face-to-face interaction with the instructor (33:2).

Television-Based Systems

It is necessary that a distinction between the terms educational television and instructional television be made. Educational television generally refers to any type of educational video program presented to teach something to someone or to develop a broad cultured understanding. Instructional television, on the other hand, generally refers to open- or closed-circuit video programs primarily designed to teach a specific subject matter as part of a formal course of study to a particular group of students (40:244).

At the present, there are several different types of educational/instructional television systems. The two basic types of systems are the broadcast system and the closed-circuit television system or CCTV (26:2). The broadcast system uses carrier waves as the method of transporting a signal to the receiver. In the CCTV system, the signal is transmitted by way of a coaxial cable. Under both systems, live or taped showings can be broadcast (16:3).

The first instructional application of television occurred in 1932 at the State University of Iowa. By the mid-fifties instructional television began to receive

serious attention. By the 1960s, almost every course in public school, college, or university curriculum was being taught somewhere by either open- or closed-circuit television, on educational or commercial stations, or in educational institutions (40:24). Since the early 1940s, instructional television has been used extensively on commercial stations and educational stations.

One of the most elaborate closed-circuit facilities in the United States was developed in 1956, in Washington County, Maryland. With the assistance of equipment manufacturers, six studios were outfitted with cameras, film projection facilities, and videotape recorders. Twenty-five instructional telecasts were made each day during a school week on such subjects as reading, art, social studies, music, advanced mathematics, science, history, English, French, and chemistry. The telecasts were transmitted to the schools in Washington County from a television center located in Hagerstown, Maryland. By 1963, every public school in the county was linked to this closed-circuit television network (40:247).

In the early 1960s, Pennsylvania State University conducted numerous experiments with closed-circuit television. Courses were offered to classes by television only, while other television courses included talk-back systems whereby the student could interact with the instructor and get an immediate response. The original experiments

indicated that the use of a closed-circuit television network did not seem to reduce the quality of instruction, or lower student accomplishment (40:248).

The growth of closed-circuit instructional television has been impressive. Evidence is accumulating which indicates that closed-circuit transmission is limited only by the creativity of those who use it. Experiments have demonstrated that once a closed-circuit system has been installed, a decreased cost of instruction per student can be realized if the system is used effectively (40:248).

A quite different approach to instructional television, in terms of transmitting medium, was the Airborne Television Instruction, Inc. (MPATI) which was developed in the early 1960s. The MPATI project, conducted in cooperation with Purdue University, recorded a comprehensive series of videotape lessons, at the elementary and secondary school level, covering a variety of subject matter areas. Fifteen educational television stations in a six-state area were then used to transmit thirty-four courses to approximately 2,000 schools. In order to reach schools not served by the stations, the MPATI project developed a plan to transmit these programs from an airplane circling about 23,000 feet over the central part of Indiana. Complete programming began in September 1961. The system provided seventy-two, half-hour television lessons in a five-hour day. The cost of establishing MPATI

exceeded eight million dollars. It has been estimated that maximum use of this system would exceed ten million dollars annually. Due to technical problems and cost, this program was terminated in 1966 (40:249).

Satellite-Based Systems

Transmission by satellite is cited as a most promising means of overcoming the logistical difficulties faced in routing television signals by normal line-of-sight and land cable techniques. Satellites might enable programs to be broadcast on a nation-wide basis without incurring the technical and institutional complexities of traditional relay networks. Regional time zones will generally require staggered transmission, even from national satellite systems, thus necessitating traffic capacities of four-fold complexity. Satellites may come to serve as a convenient variant in the relay process now dependent on land delivery methods (30:24).

As early as 1968, the Federation of Rocky Mountain State expressed interest in exploring the use of satellites to improve instruction in the small isolated school districts in its region. This project was known as the Satellite Technology Demonstration (STD). After coordinating with various public agencies such as the Joint Council on Educational Telecommunications, World Administrative Radio Conference on Space Communications, permission was granted

to the Federation of Rocky Mountain States for educational broadcasting from space (3:14).

The STD involved terminals located in sixty-eight communities throughout eight participating states. The prime educational thrust of the STD experiment was in providing career education for junior high school students. Programs were produced and videotaped in a studio in Denver and then relayed to the satellite. The developers were quick to capitalize upon the satellite's two-way communication capabilities (3:14).

Another very important project which utilized the educational satellite capabilities was the Appalachian Education Satellite Program. In this project a satellite known as the ATS-F (Applied Technology Satellite-Fairchild) was placed into orbit above the Appalachian mountain area. The ATS-F project examined the feasibility of broadcasting programs for teachers in career education and in elementary reading. More than 1,000 teachers from 150 school districts participated in the project. Many of the 1,000 teachers received graduate credit through various regional colleges and universities (5:8). The ATS-F satellite had the capability of transmitting both live and videotaped material and two-way communications (5:9).

The Appalachian Education Satellite Program was considered a success, although the experiment only lasted one year. The experiment was terminated when the Indian

government arranged to have the ATS-F satellite orbit above India and broadcast television programs to the remote towns and villages. Television sets were located in centralized meeting places so the Indian people could view programs prepared to inform them about matters such as health practices, birth control, etc. (5:9).

It is difficult to predict the future development of teleteach due to technology and cost effectiveness (38:15). Many studies concerning the effectiveness of teaching via the teleteach method have been conducted. They have indicated that teleteach classes compare favorably to conventional classes. The telephone and television have been found to be capable of being used for effective educational experience (33:2).

CHAPTER III

METHODOLOGY

Introduction

Data was gathered from four major sources. First, data was collected from magazines and company sales catalogs. Second, data was obtained from personal interviews with company representatives, school administrators of current teleteach programs, and administrators of the current MMEP. Third, data was obtained from those companies that supply teleteach equipment. The last source of data consisted of the responses to a questionnaire administered to a sample of missile combat crew members (MCCM).

Data Gathering Plan

One method used to collect data to answer the questions posed in Chapter I was a review of magazines and company sales catalogs. The sales catalogs were obtained through the mail by requesting sales representatives of the various communication companies to send any information concerning equipment applicable to a teleteach system. It was assumed that such publications had accurate cost data for the available equipment. Appendix A contains the names of the companies contacted.

Another source of data on equipment availability and cost was personal interviews and mail and telephone contact with sales representatives of the major companies supporting teleteach technologies. The questions addressed to company representatives were designed to gather data in the following areas:

1. Availability of equipment
2. Major problems with teleteach equipment
3. Operational status of equipment and current users
4. Component cost breakdowns
5. Future teleteach systems
6. Cost data on future equipment
7. Satellite use in present and future systems

The questions were presented to each respondent in the exact order indicated in Appendix B. The last question allowed the respondent to have an open response. It was assumed that the sales representatives were knowledgable in their field. Based on their expertise and knowledge, it was assumed that accurate cost data and availability of the equipment was obtained. It is, however, recognized that company biases may have been included in the responses.

Personal and telephone interviews were conducted with college professors involved with programs employing teleteach systems. This was a means of collecting data in the following general areas:

1. Experience with teleteach systems

2. Type of teleteach equipment currently in use

3. Size of teleteach networks

4. Advantages and disadvantages of teleteach

5. Applicability of teleteach to various academic disciplines

6. Quality of teleteach instruction and accreditation

7. Personal feelings toward the teleteach methods of instruction

Appendix C is a list of the specific questions. The questions were asked in an unstructured format.

The questions in Appendix D were addressed to Major General Gerald Cooke, AFIT Commandant; Colonel Lewis Israelitt, Dean, School of Systems and Logistics; Dr. J. E. Przemieniecki, Dean, AFIT School of Engineering; and Dr. R. N. Faiman, AFIT Director of Academic Affairs. These questions, which cover the following areas, were asked in an unstructured format:

1. Preference for teleteach

2. Advantages and disadvantages in the MMEP application

3. Need for graduate degrees in areas of Air Force shortages

4. Personal feelings toward a teleteach MMEP

Data was obtained from the Minuteman Education Program Three Year Plan, developed by AFIT's Dean, Civilian Institution Programs. The Three Year Plan breaks down cost of the present MMEP into the following items: salaries and wages, library acquisitions, computer support, other direct costs, and overhead.

The last block of data was concerned with the perceived attitudes of the MCCM toward a teleteach MMEP. The data collection instrument was a questionnaire used in the thesis written by Captains Donald Kemp and Andrew Rybacki and titled "Analysis of Minuteman Missile Crew Member Attitudes Toward Present Minuteman Education Program and Possible Alternatives." The questionnaire was administered to a random sample of MCCMs assigned to the six Minuteman bases. The questionnaire consisted of sixty-three questions. Only seven of the sixty-three questions were dealt with in this thesis. These questions were designed to obtain data related to two separate objectives. These two objectives are presented below:

Objective 1--to determine if the MCCMs would be willing to utilize an alternative form of material presentation if such a program were available in the MMEP.

Objective 2--to determine if MCCMs would be interested in and participate in the MMEP if alternative curriculums were available.

A copy of the applicable survey questions used to address these objectives is presented in Appendix E. Prior to the questions dealing with the various alternative methods of presentation, a short explanation of teleteach was provided. This explanation is also included in Appendix E.

The Survey Questionnaire

The questionnaire approach was chosen to provide a systematic method of gathering data from a geographically dispersed population of MCCMs. Each question allows for one of five different responses. These responses form a continuum ranging from a definite yes to a definite no.

Questions one through four, as presented in Appendix E, relate to objective one. Each of these questions deals with MCCM attitudes and their willingness to participate in one of the four alternatives presented. The aspects of the MCCMs' attitudes toward an alternative method of presentation are:

1. Willingness to participate in the MMEP using teleteach (question 1)

2. Willingness to participate in the MMEP using closed-circuit television (question 2)

3. Willingness to participate in the MMEP using prerecorded video cassettes (question 3)

4. Willingness to participate in the MMEP taught by visiting AF and civil service instructors from AFIT (question 4)

Questions five, six, and seven, as presented in Appendix E, deal with MCCM attitudes toward the MBA offered through the MMEP and their willingness to participate in alternative curriculums. These three questions relate to objective two and address a specific aspect of that objective as follows:

1. Desire to obtain a graduate degree in an area of shortage within the USAF (questions 5 and 6)

2. Desire to obtain an undergraduate degree in engineering instead of the MBA (question 7)

Each of the seven questions was cross-tabulated with a demographic question dealing with enrollment status in the current MMEP. This is question eight of Appendix F. This provided a method of measuring the effect of the alternatives on those currently enrolled and those not enrolled.

The Universe

The universe consisted of all certified MCCMs assigned to the six operational minuteman missile wings. As of August 1979, HQ SAC records reflected 1,168 MCCMs currently assigned to the six bases. These 1,168 MCCMs constituted the universe for this study.

The Population

The population consisted of the attitude and perceptions of the MCCMs assigned to the six minuteman missile wings pertaining to alternative delivery methods for use in MMEP and alternative curriculums within MMEP.

The Sampling Plan

The sample size (n) was based on the following equation:

$$n = \frac{[z(1-d/2]^2 p(1-p)}{h^2}$$

where n = samples size,

h = half width (.06),

p = maximum sample size factor (.5),

d = desired tolerance (.05), and

z = factor of assurance (1.96) for confidence level (31:300).

The formula yielded a sample size of 254; however, to insure a sound basis, a sample size of 480 was used. This was done to insure a return rate necessary to maintain the desired significance level. This sample of 480 was divided evenly among the six minuteman missile wings.

Data Collection

The sampling plan used for this study was a disproportionate random sample. The names of the eighty MCCMs

at each wing were identified by a computerized random selection technique conducted by the personnel office at AFIT. The survey questionnaires were sent to the local AFIT Detachment Commanders located at each minuteman base. The detachment commanders distributed a copy of the questionnaire to the identified MCCMs. The detachment commander was also responsible for collecting and returning the completed questionnaires.

Treatment of the Data

The treatment of the data was broken into six areas:

1. An analysis of alternative teleteach systems was conducted primarily by comparing the costs of the various components that make up each system.

2. A comparison between possible future systems was made by considering the following aspects:

   a. cost

   b. availability

   c. complexity of components

3. A comparison between current teleteach systems was made considering the following:

   a. period the system has been operational

   b. major problems

   c. time required for lesson plan preparation

   d. reliability of the system

4. The data obtained from the interviews with Major General Cooke, Colonel Israelitt, Dr. Przemieniecki, and Dr. Faiman was summarized. This section of the research was a subjective analysis on the part of the researchers in synthesizing the ideas presented by the interviewees.

5. A cost comparison between the present cost of the MMEP and the expected cost of a MMEP based on a teleteach system was made. The manning requirements were determined through the data provided by the professors, administrators, and sales representatives.

The data provided by the professors, administrators, and sales representatives was analyzed to determine information on the major component installation costs, annual leasing costs, and/or buying cost.

To compare this cost with the present cost of 2.2 million dollars per year, the following assumptions were made:

a. The type of degrees offered under the present system will differ from those offered by a MMEP based on a teleteach system. The degrees offered by a teleteach MMEP will be more oriented toward USAF advanced academic needs, such as logistics management, systems management, operations research, and engineering.

b. The cost for computer and library support at the six bases will be the same regardless of the method of conducting the MMEP.

c. The overhead costs for the physical facilities at the six Minuteman bases will not differ between instructional delivery methods.

6. The data obtained from the questionnaire administered to the MCCMs was analyzed by the use of simple descriptive statistics.

CHAPTER IV

DATA ANALYSIS

Introduction

Analysis of the data collected is divided into six areas, which will be presented in the following order:

1. Cost analysis of alternative teleteach systems
2. Future teleteach systems
3. Analysis of current teleteach programs
4. Cost comparison of current MMEP and teleteach (electronic blackboard) MMEP
5. Report of interviews with AFIT administrators concerning teleteach and the MMEP
6. Analysis of the MCCM survey

Cost Analysis of Alternative Teleteach Systems

This section compares the basic costs of the main types of teleteach equipment now in existence. The intent of this section is to identify systems currently in existence and component costs, rather than conduct an in-depth cost analysis of the alternative systems or recommend one system over the others.

The following systems will be compared:

1. Graphic tablets
2. Teleconferencing systems (telephones)
3. Electrowriters
4. Slow-scan television systems
5. Electronic blackboards

Graphic Tablets

Graphic tablet design is based on the principle that visual information can be transformed into voltage frequency signals by writing on a special conducting surface (32:86).

The graphic tablets are used with the aid of a piece of paper that is placed on the tablet's surface and a special conductive pen (32:89). The tablets that could be implemented in the teleteach system and their costs as quoted by the manufacturers are shown in Table 3.

These tablets can be used in two ways: to produce hand-drawn graphics and computer graphics (32:89). The Audiografix system is used to transmit free-hand or traced graphics over a voice-grade telephone line or radio carrier waves. The rest of the tablets can all be used to produce free-hand material, to digitalize traced information, and to position graphics that are drawn by a computer (32:89-90).

TABLE 3

GRAPHIC TABLETS

Device	Cost
Audiografix System Interrand Corp.	$4000 (transmitter and tablet)
4953 Tablet Tektronix, Inc.	$3195
5954 Tablet Tektronix, Inc.	$5295
4956 Tablet Tektronix, Inc.	$4900 to $7500
Intelligent Digitizer Summagraphics	$2400 to $6000
Cybergraphic Tablet Talos Systems, Inc.	$2500 to $6045

NOTE: The Tektronix tablets differ in resolution and accuracy.

For more exacting accuracy, push-button cursors can be purchased for $235 to $400 (32:90).

Information can be stored on a peripheral disc or a digital tape recorder for a future use. Dry process copies can also be made using a Tektronix Hardcopy Unit that costs $4,295 (32:90).

Teleconferencing Systems (Telephones)

Darome, Inc. of Harvard, Illinois is a major source of terminal teleconferencing equipment for use with

standard commercial telephone lines. Darome produces two different series of teleconferencing equipment which can either be bought or leased. One system utilizes two-wire leased lines, the others use four-wire leased lines (20). Table 4 contains the purchase and lease costs for the different models as quoted by Darome Teleconferencing Division (46). The rates in Table 4 do not include the telephone company charges; i.e., any telephone expenses incurred during conferences would have to be charged separately.

Darome can also custom design and install permanent teleconferencing systems and/or electrowriter systems.

Electrowriter Systems

The electrowriter discussed in this section is manufactured by the Talos Company of Scottsdale, Arizona. Their "advanced" electrowriter is marketed under the trade name "Telenote."

The Telenote connects remote locations via a simultaneous, multipoint, hard copy network (44:118). The Telenote system consists of an electronic system that detects the position of a special pointed writing pen, converts it to electronic signals, and then transmits it over a conventional telephone line to one or more receivers (44:118).

The Telenote system can transmit both oral and written communication simultaneously. It can also direct the signals to one or more sites by using an available

TABLE 4

DAROME TELECONFERENCING MODELS (46)

Model*	Buying Cost	Leasing 1-12 Months	Leasing 12+ Months	Leasing 3 Years
2-Wire Series				
601	782.00	65.00	48.00	30.00
610	430.00	35.00	26.00	16.50
1610	692.00	56.00	42.00	26.50
4-Wire Series				
604	861.00	70.00	55.00	33.00
611	448.00	36.00	27.00	17.50
1611	710.00	58.00	44.00	27.50

*Model 601 is 2-wire convener with 4 Model 461 microphones, auxiliary input and record output.

Model 610 is 2-wire convener with one Model 461 microphone, auxiliary input and record output.

Model 1610 is 2-wire mini-convener package containing:
1 each model 610 mini-convener
4 each Model 461 microphones
1 each Model 680 carrying case

Model 604 is 4-wire convener with 4 Model 431 microphones, auxiliary input and record output.

Model 611 is 4-wire mini-convener with 1 Model 431 microphone, auxiliary input and record output.

Model 1611 is 4-wire mini-convener package containing:
1 each Model 611 mini-convener
4 each Model 431 microphones
1 each Model 680 carrying case

selection mode. The Telenote is used by dialing the number of the site desired on a telephone and then inserting the telephone hand set in the unit's coupler (44:119). One limitation is that the telephone handsets must be capable of magnetic induction pickup of their earphone. This capability is available in Western Electric Type 500, I.T.T., or equivalent (44:118).

The Telenote system consists basically of a Telenote transmitting subsystem and a Telescreen receiving subsystem. The Telescreen has an overhead projector. The General Service Administration (GSA) quoted the costs shown in Table 5 which include conference audio capability. GSA costs are 10 percent less than those quoted by the Talos Company itself (48). These costs are for individual Telenote and Telescreens that can be used in both a sending and receiving mode.

TABLE 5

ELECTROWRITER SYSTEM

Subsystem	GSA Cost	Talos Cost
Telenote	2716.20	3018.00
Telescreen	4917.60	5464.00

Slow Scan Television Systems

Slow scan television (TV) sends a still picture, which can be recorded on audio cassette tape, over commercial audio communications circuits (41:109). A simple two-way slow scan TV system is shown in Figure 2. It basically consists of a transmitter and receiver subsystem.

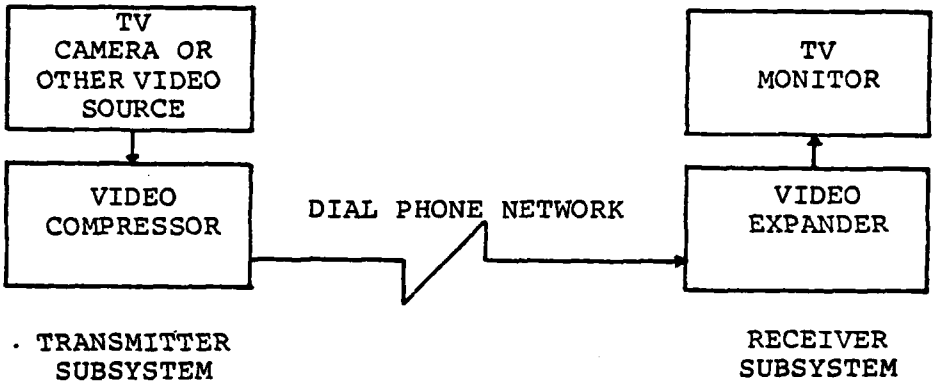

Fig. 2. One-Way Slow Scan TV System

The transmitter subsystem consists of a closed-circuit TV camera that is used for image pickup, and a video compressor which accepts standard composite video signals and converts them to slow scan TV signals. These slow scan signals are then converted to voice grade communication circuits.

The receiver subsystem consists of a video expander which receives the signals, stores them and then displays a continuous image on a standard television monitor screen.

Colorado Video, Incorporated quoted the prices listed in Table 6 for procuring their equipment (7). The cost of a TV camera and a TV monitor is $8,100 and $450 respectively (25).

TABLE 6

SLOW SCAN TV EQUIPMENT

Device	Model	Buying Cost
Video Compressor	260B	2500.00
	262A	1500.00
Video Expander	275B-1	7500.00

Electronic Blackboard Systems

The electronic blackboard can be used to transfer information, written by hand with ordinary blackboard chalk on a special blackboard, to a remote TV monitor.

The electronic blackboard system consists of the following three subsystems:

1. Input terminal
2. Transmission system
3. Display system

The input terminal is a pressure-sensitive blackboard. The dimensions of the blackboard are 1.3 meters by 1.6 meters. As shown in Figure 3, the blackboard consists of a flexible and rigid sheet separated by approximately 1.5 millimeter air gap. The front face of the flexible

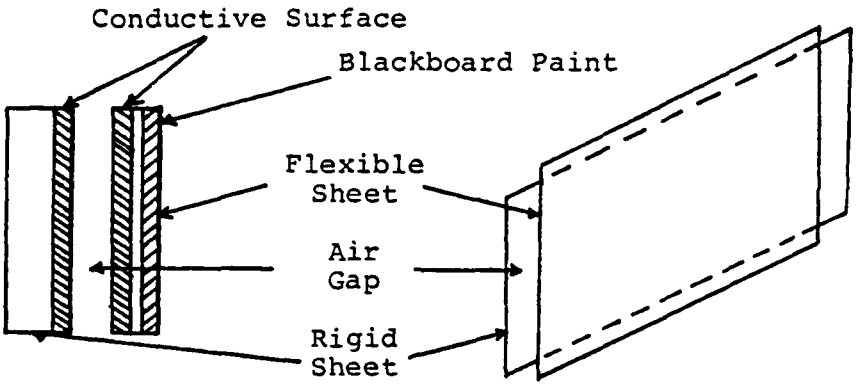

Fig. 3. Electronic Blackboard (50:124)

sheet is painted with a blackboard paint. The two facing surfaces are electrically conductive (50:124).

The information is transmitted over a narrow band telephone line. When the chalk touches the blackboard, the system is changed from the receiving to the sending mode. Lockout circuitry prevents writing from being transmitted in both directions simultaneously (50:124).

The display system consists of a conventional television monitor and a scan converter memory. The memory receives and stores the information where it will be scanned at standard television rates. A two-classroom electronic blackboard system is shown in Figure 4. The two-way voice communication is carried out on a separate telephone line using 50A1 portable conference sets (35).

The Bell Telephone Company is the only company that manufacturers the electronic blackboard. To ensure maintainability of the system the company will only lease

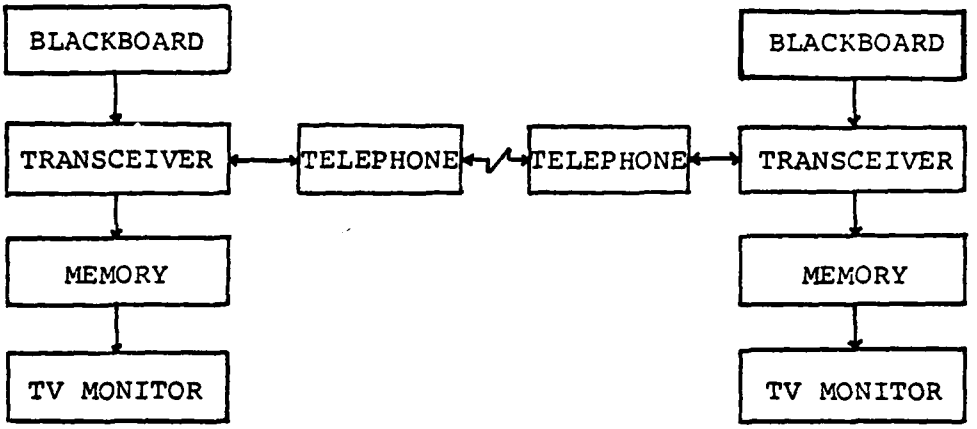

Fig. 4. Electronic Blackboard System (2)

the equipment on a monthly basis. The proposed monthly cost and one-time installation costs quoted by Bell Company are shown in Table 7.

TABLE 7

BELL'S ELECTRONIC BLACKBOARD SYSTEM

System	Device	Av. Monthly Cost	Av. Installation Cost
Input Terminal	Blackboard	114	154
	Stand	12	59
Transmission System		111	138
Display System	Memory	172	75
	Cabinet	11	55
50Al		13	58
Conference Bridge		400	13000
TOTAL		833	13539

Future Teleteach Systems

Two areas of current and present developments were identified. First, Darome, Inc. is currently working on a new graphics tablet. The Darome tablet was under development at the time of this research. Contact with the marketing department at Darome only confirmed the fact that a new tablet is under development. No further information was available at this time.

The second area of future teleteach equipment and application involves the use of satellite technologies. RCA American Communications, Inc., and Western Union Space Communications, two of the largest commercial satellite companies in the U.S., both have the technical capability for relaying teleteach transmissions. Both companies are planning to expand their satellite capabilities during the 1980s. The present satellite capabilities include data, voice, facsimile, and video transmission with access to private networks from roof-top or parking lot antennas (17).

During the 1980 decade, Western Union's second generation satellite system (Westor) will augment the company's existing transmission network. Westor was developed mainly in response to the National Aeronautics and Space Administration's need for a satellite tacking and data relay system. However, other commercial services, such as radio and TV broadcasting and satellite video conferencing, will be provided by the

Westor satellite system. Western Union feels that there is considerable growth potential in satellite video conferencing in the 1980s as the energy shortage and the cost of travel become critical. Western Union also believes that the full potential offered by the satellite transmission medium, for business, government and continuing education, is just being explored (56).

Signals are relayed from a transmitter earth station, to a transponder aboard the satellite, and then to a receiving earth station. RCA and Western Union offer leased channels and a wide range of special services plus full transponder service on a dedicated basis. Transmission can be received by small earth stations located in parking lots or rooftops. RCA American Communications, Inc. presently has over 900 cable TV operator-owned earth stations. The major uses of the satellite transmission services are basically in the profit oriented business (14).

Table 8 contains the monthly lease cost for a transponder channel and an earth system. These costs are based on an RCA domestic-satellite service price list, and vary depending upon the timeframe in which service is provided (45:1). Table 9 lists the monthly charges for a company-provided transmit earth station facility twenty-four hours a day, seven days a week (45:2). Again, the charges vary depending upon the period in which service is provided.

TABLE 8

TRANSPONDER FACILITIES
(Monthly Charges)

Period of Service	One Transponder	Two Transponders
8/1/80 to 7/31/81	$46,666	$82,833
8/1/81 to 7/31/82	54,083	91,000
8/1/82 to 7/31/83	64,583	114,666
8/1/83 to 7/31/84	76,500	135,833
8/1/84 to 7/31/85	83,500	148,333
8/1/85 to 7/31/86	83,500	148,333

TABLE 9

EARTH STATION FACILITIES

Period of Service	Monthly Charge
8/1/80 to 7/21/81	10,666
8/1/81 to 7/31/82	12,416
8/1/82 to 7/31/83	14,750
8/1/83 to 7/21/84	17,500
8/1/84 to 7/21/85	19,166
8/1/85 to 7/21/86	19,166

As the figures in Tables 8 and 9 indicate, satellite transmission is very expensive now and in the near future.

Analysis of Current Teleteach Systems

The purpose of this section is to provide an analysis of a number of on-going teleteach programs. The information was obtained from personal interviews and school literature. The analysis will consider the following:

1. Types of teleteach systems being used
2. Advantages
3. Disadvantages
4. Types of educational programs
5. Equipment malfunction
6. Future Plans

The following universities, each of which has an active, on-going teleteach program, were studied:

1. University of Wisconsin
   (Electrowriter, Teleconference)
2. Illinois State University
   (Teleconference)
3. University of Tennessee
   (Audio/Visual Tapes)
4. University of Illinois
   (Electronic Blackboard)
5. Air Force Institute of Technology
   (Electronic Blackboard)

Teleteach at the University of Wisconsin

Since the early 1960s, the University of Wisconsin has been deeply involved in the teleteach educational experience. At present, the university is involved with three types of teleteach networks, the Educational-Telephone Network (ETN), the Statewide Extension Educational Network (SEEN), and the Meet-Me Network (34:5).

ETN is basically a system of two-way audio conferencing systems. This system consists of amplified speaker units and microphones tied into a huge private telephone network. The system links over 200 classroom sites in county courthouses, campus centers, libraries, and hospitals. The system is utilized from 0700 to 2100, five days a week, nine months a year. Furthermore, all of the classes can be taped for future replay (1).

Origination of ETN programs is usually from the extension facilities at Madison, Wisconsin, but it is possible for a program to originate from any ETN location statewide. At present ETN is the world's largest private two-way audio delivery system (1).

No technical skills are needed to operate the terminal equipment. Currently, county workers are assigned the additional responsibilities of coordinator at the remote sites. Associated slides and course material for each course offered are prepared and mailed to the coordinator,

who aids in registration, distributes the class materials, insures that the classrooms are available, and monitors the terminal equipment at the remote site.

A variety of subjects are taught via the ETN. The majority of these courses are non-credit adult continuing education programs, although a limited number of credit courses are also offered. The format of the courses is generally one of lectures followed by question and answer sessions. Courses vary from one to three hours in length.

The following is a sample of just a few of the courses presently being taught by the ETN:

1. Medical Library Association Continuing Education
2. Recent Developments in Criminal Law
3. Hospital Seminar
4. Income Tax Management
5. Wisconsin Real Estate Law (13)

The SEEN is similar to ETN with respect to voice presentation and two-way conversations. However, SEEN also uses the electrowriter to permit transmission, reception, and projection of diagrams, formulas, and outlines.

Students at each of the SEEN locations throughout the State of Wisconsin are able to view the material exactly as it was written and may respond or ask questions at any time during the presentation. At present, there are approximately twenty-five remote locations using the SEEN. During

the 1977-1978 academic year over 1500 students received instruction over the SEEN (10:8).

The electrowriter presently being used was developed and manufactured by the Victor Company. The Victor Company has been out of business for a number of years. Although their units are quite old, the university does not experience many problems with them. When breakdowns do occur, the extension department's maintenance technicians effect the necessary repairs. As a future replacement for the electrowriters, the university has contracted the Darome Company to develop an electronic multi-mode graphic tablet (1).

A variety of undergraduate and graduate as well as continuing education courses are offered via the SEEN. The majority of the SEEN courses are directed to the engineering field. The following is a sample of the courses which have been presented over the SEEN:

1. Engineering Mechanics: Dynamics
2. Applied Metallurgy
3. Life Cycle Costing
4. Electrical Safety
5. Concrete Design

The Meet-Me Network uses a standard two-way line telephone system and a special bridging device developed by the Darome Company. The Meet-Me bridge is located at the extension facilities at Madison. This network is used

extensively for conference communications. Lines can be isolated into conference groups of any size. Up to twenty regular telephone lines can be bridged together for a Meet-Me conference. Conferences can be held between parties in any country that can place a telephone call to the University (13).

The Meet-Me network gives the extension programming departments the ability to offer specialized courses to statewide audiences. The Meet-Me network offers a great amount of flexibility and convenience in setting up a teleconference. Consequently, growth of the Meet-Me network has expanded rapidly in the past few years (13).

The University of Wisconsin uses twenty-five staff members at Madison. This number includes the director, managers, program coordinators, and technicians. The program coordinators aid instructors in preparing lesson plans, slides, and other course materials that are suitable for use in the teleteach environment. The staff acknowledges that it takes longer to prepare course material for use in the teleteach environment than for conventional instruction (1).

In addition to his varied management responsibilities, the director devotes a great deal of time to public relations. This effort enhances the image of teleteach through advertising and promotion of the programs at the

remote sites and within the various colleges of the University proper (1).

The main purpose of the three teleteach networks is to provide continuing education. The networks provide educational outreach to the citizens of the state who are not able to attend courses at the campus locations. The majority of the courses being taught are not accredited due only to the fact that the University's Continuing Education Department does not seek accreditation. By not seeking accreditation, the extension branch of the University is not in a position to compete with the colleges of the University proper (1).

The entire staff at the extension department of the University of Wisconsin are strong supporters of the educational experience brought on by teleteach. The greatest advantage of teleteach is giving individuals the opportunity to enhance their education at a reduced cost to the student and the university. Savings are realized in the areas of energy, time, and dollars. Additionally, there is increased convenience, accessibility, and exposure for the participants (43:2).

As state budgets have been tightening, a definite increase in the use of the three networks has been noted. The networks are attractive to the faculty because they offer a means of reaching remote students without extensive travel. The networks are also attractive to the students.

Surveys conducted by the university indicate that 80 percent of the students exposed to educational material via the teleteach networks would enroll in other courses offered via teleteach (1).

Ms. Baird, however, cites some possible disadvantages of the teleteach networks. Instructors must prepare more for the teleteach courses. They cannot employ lesson plans used in the conventional classroom. This may actually be an advantage for the students taking the teleteach course. Furthermore, it takes more effort for the instructor to maintain proper class discussion among the different remote locations. Some individuals feel that they would like to have the face-to-face relationship with the instructor or students. There is also a pessimistic attitude among the students and instructors who are unfamiliar with teleteach. Ms. Baird noted, however, that after the initial contact with teleteach, the majority reverse their attitude concerning education by teleteach (1).

Teleteach at Illinois State University

Illinois State University is presently conducting courses in graduate, undergraduate, and continuing education through its Instructional Teleconferencing System (ITS). Dr. Mary K. Huser, Director of Credit Instruction in the College of Continuing Education, is very much impressed with the success of the ITS. The ITS network originated

in the spring of 1978 with a total of ninety-five students. During the 1980 spring semester, over 244 students were enrolled (21).

The ITS system is basically a telephone system which transmits two-way audio signals. The system itself was developed by Darome, Inc. of Harvard, Illinois. The system is a portable, self-contained unit consisting of a large speaker and four microphones. The unit plugs into a standard telephone jack and an AC power outlet. All classrooms in the network have this equipment and no technical skill or special knowledge is required to operate it (21).

Instructors may originate programs from any one of the ten remote locations. Participants at any ITS location simply depress a bar on the microphone and speak with the instructor or to any other ITS student at any other ITS remote location.

Both credit and non-credit courses are offered over the ITS. Classroom instruction varies from one to three hours in length. In addition to the course offerings, the ITS network is being used for conferencing between school administrators and also for special guest lectures (22:1).

The cost of the ITS network is minimal. The cost per instructional hour for the courses average about $14 per contact hour. However, this cost only reflects the

telephone system rental, payment of the station equipment, and its operation, not the instructors' salary (47:2).

During the spring of 1979, students taking courses through the ITS responded to a questionnaire developed by the University (39). According to Dr. Huser, the majority of the respondents favored the ITS. Seventy percent of the students responding to the questionnaire stated that the extent of their learning in the ITS environment was the same or greater than that of a similar course in a regular campus classroom. Seventy percent also stated that they would recommend the ITS courses. However, response to questions dealing with the students' ability to listen to or communicate with the instructor were unfavorable when compared to regular classroom courses (39).

Several advantages and disadvantages were given for the ITS(47:3). The following are some of the disadvantages:

1. It is difficult to make the dispersed students function as "a group."

2. It is difficult to initiate discussion among the dispersed students.

3. It is difficult to maintain student attention span for the length of the class.

4. Instructors find it more difficult to prepare and conduct the classes.

5. More instructor effort is needed in conducting the ITS classes.

Another disadvantage of the ITS stems from the fact that Illinois State University must work with a number of different telephone companies. This increases the costs of the conferences and complicates the planning process (21).

Two primary advantages are given for the ITS. First, is the minimal cost of operating the network. Second, is the ability to provide an increased number of students with an opportunity to take courses without traveling to the campus.

Dr. Huser would like to be able to work with only one telephone company, but this is not likely in central Illinois. To avoid the problems generated by operating the ITS on lines leased from several telephone companies, the University is presently looking into the possibility of using a satellite communications channel in the near future (2).

Teleteach at the University of Tennessee

The University of Tennessee provides an opportunity for employed engineers in the State of Tennessee to further their education at their own job locations. Presently master's degree programs are available in Engineering Administration; Civil, Chemical, Metallurgical, Electrical, Industrial, Mechanical, Aerospace, and Nuclear Engineering; and Engineering Science (18). The courses are transmitted to off-campus locations by video tapes made of live classes

held at the Knoxville campus. Communications between the instructors and the remote students are available via pre-arranged telephone conversations and by on-site and on-campus visits.

The educational network provides education for employed engineers having an undergraduate in engineering. The teleteach system serves two goals of the University--teaching and public service. Basically the teleteach program is an extension of on-campus work at the master's level, not continuing education in the sense continuing education is often used (27:1).

The teleteach system was initially started in 1966, with the use of the Victor Electrowriter and the telephone. The electrowriter was used quite extensively through 1969. Beginning in 1969, attempts were made to improve the electrowriter/telephone mode of instructional presentation by videotaping the live on-campus classes. The prime motive for this change was the distortion of transmitted images that resulted from the sensitive electrowriter (28).

The teleteach system presently being used is known by the acronym VERM, Videotape Electrowriter Remote Mode. Currently there are six studios on the Knoxville campus available for videotaping live classes. Physical arrangements and equipment vary from room to room; however, each room contains two television cameras, tables equipped with microphones, and a control room (27:2).

One of the television cameras is mounted at the rear of the room and is fitted with a remotely controlled tilt arrangement and zoom lens. The professor can work at either his deak or the blackboard. The camera in the back of the room can pick up his blackboard work and record it on tape. The second camera, which is also equipped with a zoom lens, is mounted directly above the teacher's desk and aimed downward. This camera can pick up notes, pictures or graphs from books or any other material the professor uses on his desk. The majority of the instructors prefer not to use the blackboard, but to remain at the desk to do their writing on a standard pad of paper. Local classes can see what is written by observing two television monitors in the classroom.

The television operator sits in a control room near the classroom. Three television monitors, one showing the picture seen by the camera at the rear of the room, one showing the picture seen by the overhead camera, and one showing the picture that is being recorded on tape, are all controlled by the operator. The operator can switch between cameras with push buttons located on the control panel. Also on the panel are the zoom and focus controls for both cameras.

Taped class sessions normally last fifty-five minutes. Two one-hour tapes are recorded and played back at the remote location either once or twice a week. Before

each session at the remote locations a fifteen to thirty-minute telephone-electrowriter session is conducted by the instructor with the remote students. According to Dr. William A. Miller, Associate Dean of Engineering, the electrowriter is rarely used. A coordinator at the remote locations assists the students by passing out and collecting homework problems, administering exams, and setting up the television and the electrowriter (28).

The telephone communication system uses the standard WATTS line system. A weekly scheduled thirty-minute telephone conservation between the instructor and the students is conducted for each course. The instructors, as well as the students, feel that there must be a well understood, easily implemented means of two-way communication between students and instructor.

In January of 1972 the off-campus master's degree program in engineering was accredited by the Southern Association of Colleges and Schools (27:3). Although the videotape classes originated in the College of Engineering, over 122 other types of courses have been offered by this means.

Table 10 contains the number of remote locations, the number of engineering courses offered, and the number of students who participated in the VERM program during each of the past five years (18).

TABLE 10

UNIVERSITY OF TENNESSEE'S VERM PROGRAM

Academic Year	Engineering Courses	Remote Locations	Remote Students	On-Campus Students
1974-1975	53	12	594	702
1975-1976	49	16	486	561
1976-1977	47	18	559	537
1977-1978	39	20	523	435
1978-1979	45	21	466	444

Table 11 lists the number of the various master's degrees awarded to off-campus students with a significant amount of work completed by videotape. Over 50 percent of the requirements completed by videotape is considered significant (18). Any courses requiring laboratory work must be taken on campus. The high number of degrees awarded in the Industrial Engineering and Engineering Administration programs is understandable since these programs require minimum laboratory work.

According to Dr. Miller, there are numerous disadvantages to the VERM teleteach system. First, instructors tend to miss the face-to-face feedback from the remote locations. Second, there seems to be a tendency for the students in the classroom which is being taped not to ask as many questions as they would in a conventional classroom. Instructors have noted that these classes have much

TABLE 11

DEGREES AWARDED BY VERM

Major	Number
Chemical Engineering	4
Civil Engineering	1
Electrical Engineering	7
Engineering Administration	65
Engineering Science	2
Industrial Engineering	33
Metallurgical Engineering	1
Nuclear Engineering	1
	114

longer post class sessions than do conventional classes. At present, a student in the live classroom must key a microphone in order to ask a question. This appears to be restrictive. To reduce this problem the old microphones are being replaced with microphones installed in the ceiling. These new microphones will not need to be keyed. A third disadvantage concerns the laboratories. Currently no course requiring laboratory work is being taped. Finally, there is no two-way communication with the remote locations and the instructor at the time the remote students are viewing the videotapes (28).

The greatest advantage of VERM is that it allows engineers with full-time jobs to pursue an advanced education without sacrificing their job. The students at the remote locations like the convenience of being able to view the taped classroom at their own pace. Instructors tend to prepare better lesson plans for the VERM courses because they are being taped (28).

No cost information could be obtained due to the fact that instructors are paid by their respective departments and the companies pay the expense of the teleteach system at their locations. No in-depth study of the cost has been conducted by the university (28).

As far as improvements to the system are concerned, the university would prefer to use color tape instead of black and white. The university would also prefer to switch from reel to reel tapes to cassettes. This would cut down storage and mailing costs. They have considered slow-scan television but the resolution is not sharp enough for their purpose. Closed-circuit television is presently out of the picture due to the high cost of such systems (28).

Teleteach at the University of Illinois

The University of Illinois is granting graduate degrees in engineering through a teleteach program. The program originates from the campus at Urbana, Illinois.

The remote resident courses are available at graduate centers (remote classrooms) located in companies, community colleges, government facilities, and community education centers (19).

Teaching centers are specially equipped classrooms on the Urbana campus. The teleteach system being used is based on the electronic blackboard. At the teaching center the university uses three electronic blackboards which are electronically connected. This was done because the engineering instructors believe that they need more chalkboard space for conducting the classes. There is also special equipment for the transmission of the information written on the electronic blackboard over a voice grade telephone communications network (6).

The graduate centers are equipped to receive the electronic blackboard images over the telephone communications network. Each remote location has three television monitors to display the data from the electronic blackboards at the teaching centers. Each remote location also has an electronic blackboard. This allows the students to feed back information to the instructor in a written manner.

Tape recording facilities are available at both the teaching and graduate centers. Information and data essential to the graduate class being presented on the educational network can be recorded for later use by the students

in the program. Tape libraries are maintained at the teaching center and each of the graduate centers. Each center also has complete playback capabilities.

Presently the teleteach system used by the University of Illinois utilizes two large telephone networks. These networks serve the Chicago and Champaign areas. In these areas the primary user of the network consists of the many businesses needing graduate engineers. There is, however, a growing number of junior colleges increasing their participation in the program.

The following is a sample of the courses which have been offered over the network:

1. Electric and Magnetic Fields
2. Gaseous Electronics and Plasmas
3. Electrical Engineering Problems
4. Quantum Electronics
5. Nuclear Power Engineering (12)

The University of Illinois originally began its teleteach program using the Victor Electrowriter. Several problems with the electrowriter caused the transition to the electronic blackboard. First, the small size of the writing surface severely limited the instructors in their presentation. Second, the writing surface had to be kept extremely clean to prevent distortion of the transmitted image. Finally, the university experienced many mechanical difficulties with the electrowriter (19).

The university feels that the teleteach system has both advantages and disadvantages (19). One disadvantage is that instructors feel that they need the nonverbal feedback from the students. This feedback is lost when there is no face-to-face contact between instructor and student. Another disadvantage is in the mailing of the exams and homework through the U.S. mail service. A turnaround time of two weeks is not uncommon for the homework and exams. This is not satisfactory to the students. As a final disadvantage, the instructors tend to believe that they are doing more work for the same amount of pay. For example, a normal class of twenty students can be increased to seventy or more students through teleteach.

The advantages are the cost savings plus the opportunity for many more students to receive the education. The capability to review the taped class sessions is an extremely important advantage since the majority of the students have full-time employment and occasionally miss classes. The university believes that, in general, the majority of the students like the teleteach systems (19).

As far as future concerns, the university would like to see if the electronic blackboard could be equipped with a visual pointer. The ability to use color and computer graphics with the electronic blackboard would also be desirable. The use of satellite communications networks

is presently out of the consideration due to the high cost of such networks (19).

Teleteach at the Air Force Institute of Technology

AFIT has operated a teleteach program since October of 1979. AFIT's system, the Teleteach Expanded Delivery System (TEDS), originates from two classrooms located in the School of Systems and Logistics. These classrooms can be connected to either one of two networks. One network terminates at the five Air Logistics Centers, the other network terminates at four Air Force Systems Command bases. Furthermore, all eleven locations can be connected as one large network.

All eleven classrooms have an electronic blackboard, a stereo tape recorder, two video monitors, a portable conference telephone set, two audio mixers, a 35mm slide projector, an overhead projector, and a projection screen. The remote classrooms have eight student microphones and the two originating classrooms have a single omnidirectional microphone (4).

The primary purpose of the networks is instructional. Classes are scheduled for a number of continuing education courses. To date, the offerings have included the following:

1. Material Management
2. Fundamentals of Acquisition Management

3. Systems Program Management

4. Principals of Contract Pricing

These courses are taught in four and a half hour blocks, five days a week. The classes begin around 1100 at Wright-Patterson AFB, Ohio. This allows for a reasonable start time on the west coast (4).

Offerings are being expanded to include courses taught by the School of Engineering, courses aimed at the needs of Air Force Reservists, and specialized training for Systems Command and Logistics Command. These two commands also use the networks for command briefings and conferences (4).

According to Dr. R. S. Christopher, Chief, Plans and Education Division, the networks experience only minor maintenance problems. These problems involve audio interference at all locations. Dr. Christopher believes this interference is the result of the unique electronic, radio, and radar equipment typical at Air Force bases. It is certain that the interference is not the result of the leased telephone lines and associated bridging equipment.

Due to the Air Force budgeting process, Dr. Christopher did not speak of cost savings. Instead, he referred to cost avoidance. Based on the number of students who have or are projected to attend teleteach courses and the initial cost of the system, Dr. Christopher stated that expenditures of over $261,000 will be avoided during fiscal

year 1980. The cost avoided results primarily from money not spent on travel and per diem.

The time to prepare for a first-time teleteach course is considerable. The use of the 35mm slides accounts for much of the lead time. A twelve-week lead time is required for preparing the slides. There is also considerable time devoted to the logistics involved in setting up a teleteach course. No new personnel have yet been added to support the TEDS programs. This has been an irritant to the AFIT faculty and administration (4).

The plans for expanding the TEDS are extensive. The originating classrooms are to be relocated so as to provide centralized management of the TEDS. This relocation will also allow for one more originating classroom to be added to the system. Additional remote classrooms are also planned. One new remote classroom is planned for the Logistics Command network and fifteen are planned for the Systems Command network.

Dr. Christopher indicated that a video taping classroom is also planned. Classes will be recorded on videocassettes and duplicate cassettes will be sent to various locations throughout the country. Prearranged call-in times will be established to provide student-instructor conferences.

Several advantages of teleteach were identified by Dr. Christopher. The economics of the teleteach delivery

method are impressive. The travel and per diem dollars not spent are considerable. The convenience for the students is another noteworthy advantage. Students do not need to be away from their home and families in order to attend classes. Finally, the Air Force reaps enormous benefits by having more of its people exposed to the material.

Dr. Christopher stated that the concept is not without its disadvantages. Both the students and the faculty express concern about the lack of face-to-face contact. Preparation and lead time required to get a new course on-line is much longer. Faculty state that teleteach does not allow sufficient flexibility to alter the lesson plan after the course has begun. Finally, when part of the network is down for mechanical problems, all the classes must wait until the problems are resolved (4).

Cost Comparison Between the Current MMEP and a Teleteach MMEP via the Electronic Blackboard

The purpose of this section is to compare the cost of the current MMEP to an MMEP conducted using an electronic blackboard-based teleteach network. Degrees awarded under the teleteach MMEP could be from AFIT's School of Systems and Logistics. The electronic blackboard system used in this comparison is similar to the system currently used by AFIT.

The electronic blackboard was chosen for this comparison because it is readily available, it is reliable, and because AFIT has had some experience working with this system in its Professional Continuing Education Programs. Degree programs from other AFIT resident schools were not considered because of difficulties in determining the costs involved with the required laboratory work.

In developing the cost comparison, several assumptions were made.

1. Manning requirements at the detachments would consist of the following personnel.

    a. One administrator/professor

    b. Two full-time professors

    c. Two secretaries

    d. One librarian

2. Increased manning requirements at the Air Force Institute of Technology would consist of four additional professors.

3. Only one electronic blackboard would be maintained at each detachment and at AFIT.

4. The degrees granted would be from curriculums currently available at the School of Systems and Logistics.

5. One teleteach classroom will be established at each missile wing AFIT detachment and one will be established at AFIT itself.

6. Graphic and slide projection costs would be included in direct costs.

The cost of the electronic blackboard network is broken down into the following areas:

1. Cost of supplemental equipment and installation costs of major equipment components (amortized over five years)

2. Leasing cost of major equipment items

3. Transmission line costs

4. Wages and salaries of instructors and administrators

5. Computer support, direct costs, overhead costs

Cost of Supplemental Equipment and Installation Costs of Major Equipment Components

Table 12 contains the cost of the supplemental equipment needed to implement the MMEP teleteach network (25). The number of required items was determined based on the assumption that each detachment and AFIT would require a backup item. Table 13 contains the installation cost of the major equipment items (35).

Table 14 shows the amortization of the supplemental equipment cost and the installation cost of the major equipment items of the electronic blackboard system, over a five-year period.

TABLE 12

COST OF SUPPLEMENTAL EQUIPMENT

Equipment	Number Required	Cost
TV Monitors	14 ($450 each)	6,300
Stereo Tape Recorders	14 ($180 each)	2,520
Student Microphones	63 ($ 54 each)	3,402
Audio Mixers	14 ($149 each)	1,946
35mm Slide Projectors	14 ($172 each)	2,408
Overhead Projectors	14 ($499 each)	6,986
Projection Screens	14 ($ 93 each)	1,302
Total		24,864

TABLE 13

INSTALLATION COST OF THE MAJOR COMPONENTS OF THE ELECTRONIC BLACKBOARD SYSTEM

System Component	Cost per Unit	System Installation Costs (7 Classrooms)
Blackboard	154	1,078
Terminal Stand	59	413
Transmission System	138	966
Display Memory	75	525
Memory Cabinet	55	385
50A1 Conference Phone	58	406
Dedicated line	758**	758
Conference Bridge	13,000*	13,000
Total		17,531

*Only one required per network.

**One-time charge for entire network.

TABLE 14

FIVE-YEAR AMORTIZATION OF THE SUPPLEMENTAL EQUIPMENT COST AND INSTALLATION COST OF MAJOR COMPONENTS

Total Cost	1980	1981	1982	1983	1984
24,864	4,973	4,973	4,973	4,973	4,973
17,531	3,506	3,506	3,506	3,506	3,506
42,395	8,479	8,479	8,479	8,479	8,479

Leasing Cost of Major Equipment Items

Table 15 (35) shows the average monthly rental fees of the major equipment items of the electronic blackboard system based on the assumption of one electronic blackboard at each detachment and at AFIT.

TABLE 15

LEASING COST OF MAJOR EQUIPMENT ITEMS (MONTHLY)

System Component	Leasing Cost Per Unit	System Leasing Costs (7 Classrooms)
Blackboard	114	798
Terminal Stand	12	84
Transmission System	122	854
Display Memory	172	1,204
50A1 Conference Phone	13	91
Conference Bridge	400*	400
Total		3,431

NOTE: Total leasing cost for one year is $41,172.

*Only one required per network.

Transmission Line Costs

The conference lines could be any type of normal commercial telephone lines. American Telephone and Telegraph recommends using dedicated telephone lines throughout the network. The dedicated lines allow stricter control over the transmission by controlling the signal band pass, signal levels, and signal-to-noise ratio (34:19). Table 16 summarizes the costs of the conference lines to each missile wing.

Wages and Salaries of Instructors and Administrators

Table 17 indicates the salaries and wages of the personnel needed in the MMEP teleteach network based on the fiscal year 1980 General Service fifth level pay scale. At each detachment there will be one administrator/professor, two full-time professors, two secretaries, and a librarian. AFIT will add four professors.

Computer Support, Other Direct Costs, and Overhead Costs

Another assumption which was made is that the library, computer support, and other direct costs will be unchanged from the current MMEP. However, it is believed that these costs could be lower in a teleteach-based MMEP. These costs currently include travel costs of university administrators, coordinators, directors, and deans; moving costs for resident academic administrators and faculty;

TABLE 16

DEDICATED CONFERENCE LINE COSTS**

Current AFIT MMEP Detachments	Leasing Company	Av. Monthly Leasing Cost	Av. Monthly Service Cost	Total Annual Cost
Malmstrom	St. Talls MT	724.00	86.60	9,727.2
Ellsworth	Rapid City SD	516.50	86.60	7,237.2
Whiteman	Knob Noster MO	253.00	86.60	4,075.2
Minot	Minot ND	516.50	86.60*	7,237.2
F.E. Warren	Cheyenne WY	542.50	86.60	7,549.2
Grand Forks	Grand Forks ND (Emerado ND)	431.50	86.60	6,217.2
Total				42,043.2

*This cost could be higher because the local company charges high service costs.

**Costs based on lines originating at Wright-Patterson Air Force Base.

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THE APPLICABILITY OF TELETEACH TECHNOLOGIES TO THE MINUTEMAN ED--ETC(U)
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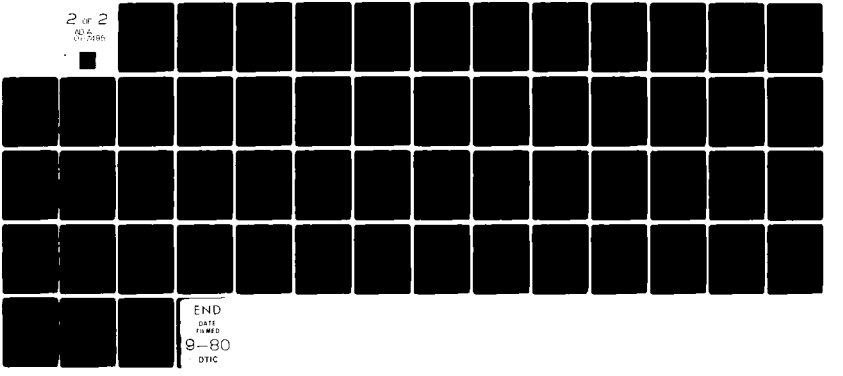

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TABLE 17

SALARIES AND WAGES OF PERSONNEL IN THE MMEP VIA TELETEACH

Position	Number of Personnel	Pay Grade	Base Salary	Total Salary
Administrators/ Professors	6	GS-14	39,341	236,046
Professors	16	GS-13	33,291	532,656
Librarians	6	GS-5	12,743	76,458
Secretaries	6	GS-5	12,743	76,458
Secretaries	6	GS-4	11,389	68,334
Total				989,952*

*Total annual salaries and wages of all personnel.

communication services; supplies; and miscellaneous equipment. Present overhead costs are based on 16 percent of the present salaries and wages. This same percentage was used in the determination of the teleteach-based MMEP overhead charges.

Table 18 (53:p.3-21) indicates the library, computer support, other direct costs, and the overhead costs. Table 19 summarizes all the costs of implementing the MMEP based on the electronic blackboard system for the year 1980. Table 20 (53:p.3-21) contains the fiscal year 1980 budget for the current MMEP, based on the Three Year Plan.

TABLE 18

OTHER COSTS

Costs (1980)	
Library	52,812
Computer Support	93,512
Overhead Direct Costs	140,977
Overhead	158,392
Total Cost	445,693

TABLE 19

MMEP COST VIA ELECTRONIC BLACKBOARD-BASED TELETEACH--
FISCAL YEAR 1980

Salaries and Wages	989,952
Supplemental Equipment	4,973
Installation Costs	3,506
Rental Costs	41,172
Transmission Line Rental	42,043
Library Costs	52,812
Computer Support	93,512
Other Direct Costs	140,977
Overhead	158,392
Total Cost	1,527,339

TABLE 20

CURRENT MMEP COSTS

Salaries and Wages	1,522,049
Benefits*	199,858
Library	52,812
Computer Support	93,512
Other Direct Costs	140,977
Overhead	245,018
Total Cost	2,254,226

*Benefits include health and accident insurance, industrial accidents and disability insurance, and retirement for the university staff.

The total cost of the MMEP via the electronic blackboard-based teleteach network as compared to the current MMEP has the potential savings of $726,887 in fiscal year 1980. This is approximately 32 percent savings over the current MMEP.

Report of Interviews with AFIT Administrators Concerning Teleteach and the MMEP

Interviews with the AFIT Commandant, the Dean of the School of Systems and Logistics, the Dean of the School of Engineering, and the Director of Academic Affairs, were conducted. These administrators would be key in the implementation of a teleteach-based MMEP. Their thoughts on teleteach and MMEP are summarized in this section.

AFIT Commandant

Major General G. E. Cooke is concerned with the quality of education. He believes that a physical reinforcement in a laboratory for the theory that the student has studied in class is necessary. This is the only way that a student will be able to retain the concepts learned in the classroom. He believes that teleteach has the capability of only delivering information. It is up to the receiver to transform the new information into education. The problem of insuring this transformation is of concern to General Cooke (7).

General Cooke believes that managerial and qualitative courses can be taught using the teleteach system. However, he does not believe that an engineering curriculum can effectively be taught without the laboratory work to reinforce the theory (7).

The General stated that the advantage of teleteach lies in its ability to transfer a large amount of information to a large number of students in a very inexpensive manner. The major disadvantage lies in the inability to achieve personal and professional reinforcement which he believes is required in education.

General Cooke believes that an implementation of teleteach in the MMEP would face considerable political and economical resistance from the civilian universities currently contracted to support the MMEP. He also feels

there would be considerable resistance from the faculty members. General Cooke also stated that accrediting the courses taught via teleteach might be a major problem. He feels that since teleteach is an unstructured system, personal supervision would still need to be contracted for from local universities. This factor, states General Cooke, would compound the accreditation problems (7).

AFIT Dean, School of Systems and Logistics

Colonel Lewis M. Israelitt believes that teleteach is the way of the future. The technology is not new and is suitable in almost every case. He believes teleteach could be applied to the MMEP (24).

Colonel Israelitt believes that teleteach has the capability to provide graduate education in academic areas in which the Air Force is faced with shortages. Colonel Israelitt has conducted research in this area and believes that the results support the preceding idea.

Colonel Israelitt does not perceive any problems in using the teleteach technologies in an undergraduate engineering program. The Air Force demands a high number of engineers and skilled managers. This need can, according to Colonel Israelitt, be met through the implementation of a teleteach system. He believes that the faculty of the engineering school will have initial resistance to the use of a teleteach system; however, once they realize that this

technology can be used to reach a much larger number of students, they will be willing to utilize the teleteach system.

Colonel Israelitt stated that the requirement of a thesis is one area of concern. In the MMEP environment, he believes that the orientation of the thesis toward the problems at the student's missile wing would have many benefits. Another area of concern that would arise in an undergraduate engineering program would be the laboratory work. Colonel Israelitt believes that this problem can be solved by delaying the laboratory work and consolidating it at the end of the course. The students could then be sent to AFIT for the last quarter to accomplish the laboratory requirements (24).

AFIT Dean, School of Engineering

Dr. J. S. Przemieniecki's overall view of the use of teleteach in the MMEP, with AFIT as the resident program coordinator, is that there are a great number of disadvantages which would have to be overcome (36). If an engineering curriculum were involved, the laboratory requirements would be an extremely difficult obstacle to overcome. Presently, resident engineering students have the capability and access to numerous engineering laboratories located at Wright-Patterson AFB. Also, due to the technical and conceptual difficulties of many types of

engineering courses, Dr. Przemieniecki believes that the face-to-face contact with the instructor is extremely important.

Regardless of the curriculum, Dr. Przemieniecki perceives problems with the thesis requirement presently in force at AFIT. He also believes that teleteach would greatly reduce the instructor's flexibility in making last-minute changes to his presentations.

Dr. Przemieniecki believes that certain courses can be taught effectively over teleteach. However, the undertaking of presenting the entire MMEP via teleteach presents tremendous problems concerning the administration of the program and with the adequacy of the quality of the education (36).

AFIT Director of Academic Affairs

Dr. Robert N. Faiman believes that teleteach is just one of many instructional presentation technologies (15). The teleteach technology is not new and is solidly established. As an alternative to conventional instruction, Dr. Fairman believes teleteach is a suitable method for presenting educational material. He does not, however, believe that teleteach is suitable in every case. He does not believe teleteach would be suitable for MMEP.

Dr. Faiman presented three main arguments against the use of teletach in the MMEP. First, the current

curriculum would not lend itself well to a teleteach approach. Teleteach, stated Dr. Faiman, is most suitable for quantitative courses such as statistics, mathematics, and engineering. According to Dr. Faiman, teleteach would not be suitable to group discussion or case type classes commonly found in business or management curriculum.

Second, Dr. Faiman feels that the current MMEP is "tailor made" to the individual student and that a great deal of flexibility exists in the current program. Dr. Faiman does not feel that these same characteristics could be provided if the MMEP were conducted via teleteach. There is no single block of courses available at AFIT that can replace the personalized program currently available through the MMEP. AFIT cannot export a great variety of course work. This is so, according to Dr. Faiman, because of required research such as theses and laboratory work inherent in the programs currently conducted in residence at AFIT.

Such AFIT courses as undergraduate engineering could not be exported without considerable loss of overall course quality. While teleteach would be suitable for a lot of these courses, Dr. Faiman feels the loss of the laboratories, student-to-student and student-to-instructor interchanges, and easy accessibility to the instructor would greatly reduce the quality of the programs.

Dr. Faiman's final argument against the use of teleteach in the MMEP dealt with the purpose of the MMEP. The MMEP is a major benefit of being a missile combat crew member. Dr. Faiman feels that MCCMs would have strong negative reactions to a teleteach MMEP and would perceive a teleteach MMEP to be a canned program and of reduced quality. The MCCMs would view this as a loss of a major benefit of being on crew.

In summary, Dr. Faiman does not believe that AFIT could support a teleteach program to the six minuteman missile wings as a replacement for the MMEP. AFIT cannot provide the variety of courses that would be necessary to offer the personalized program that Dr. Faiman states exists in the current MMEP. Dr. Faiman believes that the current MMEP could be replaced by a teleteach MMEP, but that in doing so the quality of the programs would suffer greatly. Additionally, MCCMs would perceive a teleteach MMEP as an inferior alternative and, thereby, view a teleteach MMEP as a loss of another benefit.

Analysis of the MCCM Survey

Four hundred and eighty (480) questionnaires were sent to the AFIT detachment commanders at each of the six minuteman missile wings. The questionnaires were then distributed to eighty MCCMs at each of the wings. Sixty percent of two hundred and eighty-three (283) questionnaires

were returned. Five of these were unusable due to multiple responses per question. Two hundred and seventy-eight (278) valid response sheets were examined.

Eight questions were considered in this thesis. The first question of interest was:

> Have you graduated from or are you presently enrolled in the Minuteman Education Program (MMEP)?

The responses to this question were as follows:

a.	YES	55.0%	
b.	NO, but I plan to participate in the MMEP.	7.2%	45%
c.	NO, but I am considering MMEP participation.	6.8%	
d.	NO, and I do not intend to participate in the MMEP.	30.9%	

These results indicate that there is little middle-of-the-ground in MMEP participation. The greatest percentage of the respondents are at one end of the scale or the other. The total non-enrolled percentage is approximately 45 percent. It should be emphasized that the first response includes both those currently enrolled in MMEP and those who have graduated from the program. This was done to satisfy requirements generated by the other thesis team using the survey data.

The value of this question rests in its use with the questions dealing with alternative presentation technologies and alternative curriculums. These questions were cross-tabulated with the question dealing with enrollment status. This allowed a determination of the effects

of the alternate presentation technologies and curriculum on those enrolled in MMEP and those not enrolled.

Analysis of Objective One

This objective addressed MCCM attitudes toward the use of alternative methods of presenting the educational material utilized in the MMEP. Alternatives presented as options in the questionnaire included teleteach, closed-circuit television, prerecorded video cassettes, and visiting professors from AFIT's resident schools.

Since teleteach is a term that would be unfamiliar to most MCCM, a brief description of this concept was included in the questionnaire (see Appendix F) immediately prior to the following question:

> Would you participate in MMEP if a substantial portion of the classroom instruction originated elsewhere, but was brought to the classroom in real time via audio-visual telecommunications equipment?

The responses to this question were as follows:

a.	A definite YES	17.3%	41.4%
b.	A qualified YES	24.1%	
c.	Neutral/Undecided	27.3%	
d.	A qualified NO	14.7%	31.2%
e.	A definite NO	16.5%	

The high percentage of neutral/undecided responses could indicate that there was a great deal of unfamiliarity with the concept of teleteach. While there was not a majority of respondents answering in any of the categories, the percentages of combined YES responses (41.4 percent)

was well above the combined percentage of combined NO responses (31.2 percent).

Even though a description of teleteach technology was included in the questionnaire, the majority of administrators interviewed while conducting this research, indicated that students, as well as instructors, have pessimistic perceptions of any teleteach educational system. The administrators, however, did indicate that students generally adopt a more positive attitude toward teleteach as the student becomes more involved in the teleteach experience. This leads to the expectation that the 31.2 percent that indicated they would not participate in a teleteach MMEP might be reduced after such a program got under way. Additionally, many of those in the neutral/undecided category might be inclined to participate when the program is better understood.

The cross-tabulation (Table 21) of the above question with the question dealing with enrollment status also provided encouragement about the acceptability of teleteach to the respondents. Of the 45 percent of the respondents that indicated they are not enrolled in MMEP, 33.6 percent responded with a definite or qualified YES to the question dealing with the willingness of MCCMs to participate in a teleteach MMEP. Almost 37 percent were neutral/undecided and 32.8 percent were in the qualified or definite NO category. Of the respondents that are

TABLE 21

CROSS-TABULATION OF ENROLLMENT STATUS AND MCCM WILLINGNESS TO PARTICIPATE IN THE MMEP USING TELETEACH

	Would be willing to participate in the MMEP if teleteach were used				
	A definite YES	A qualified YES	Neutral/ Undecided	A qualified NO	A definite NO
Graduate or Currently Enrolled	20.9%	26.8% (47.7%)*	22.2%	16.3%	13.7% (30.0%)
Not Currently Enrolled	12.8%	20.8% (33.6%)	33.6%	12.8%	20.0% (32.8%)

*Values in parentheses are sums of values above them.

currently enrolled or graduated from MMEP, 47.7 percent responded with a definite or qualified YES. Only 30 percent responded with a qualified or definite NO.

It appears that teleteach could result in a net increase in enrollment in the MMEP. Thus, the initial indications are that the teleteach technology may receive enough MCCM support to provide a viable alternative to the current mode of operating the MMEP.

The alternative of closed-circuit television was examined through the following question.

> Would you participate in a MMEP in which closed-circuit television was utilized in presenting course material in your classroom?

The responses to this question were as follows:

a.	A definite YES	11.9%	36.7%
b.	A qualified YES	24.8%	
c.	Neutral/Undecided	23.4%	
d.	A qualified NO	19.1%	40.0%
e.	A definite NO	20.9%	

The respondents are virtually equally divided in their attitudes about the alternative of closed-circuit television. The combined NO answers do indicate a slight dislike for this alternative.

When cross-tabulated (Table 22) with the question dealing with enrollment status, the question addressing the closed-circuit television alternative continues to indicate the presence of negative feelings toward closed-circuit television. Of the 45 percent of the respondents who are not enrolled in the MMEP, only 30.4 percent responded with a definite or qualified YES to the closed-circuit television alternative. This is compared to 42.4 percent who responded with a definite or qualified NO. Of the graduates and current enrollees, 41.8 percent responded with a definite or qualified YES, while 37.9 percent responded with a qualified or definite NO to the closed-circuit television alternative. It appears that closed-circuit television would not result in motivating non-enrollees to enroll. It may, in fact, cause current students to disenroll.

This apparent dislike for closed-circuit television would be expected if the respondents placed a high value on

TABLE 22

CROSS-TABULATION OF ENROLLMENT STATUS AND MCCM WILLINGNESS TO PARTICIPATE IN THE MMEP USING CLOSED-CIRCUIT TELEVISION

	Would be willing to participate in the MMEP if closed-circuit television were used				
	A definite YES	A qualified YES	Neutral/ Undecided	A qualified NO	A definite NO
Graduate or Currently Enrolled	13.7%	28.1% (41.8%)*	20.3%	18.3%	19.6% (37.9%)
Not Currently Enrolled	9.6%	20.8% (30.4%)	27.2%	20.0%	22.4% (42.4%)

*Values in parentheses are sums of values above them.

two-way communication between student and instructor. Contacts with manufacturers during this research have indicated that this capability does exist; however, the description of the alternatives presented in the questionnaire (see Appendix E) did not reflect this. According to the description provided, two-way communication via closed-circuit television was not possible.

The following question addressed the alternative of prerecorded video cassettes.

> Would you participate in a MMEP in which a substantial portion of the classroom instruction was prerecorded on video cassettes, which could be transported to the launch control center?

The responses to this question were as follows:

a.	A definite YES	24.1%	54.0%
b.	A qualified YES	29.9%	
c.	Neutral/Undecided	15.8%	
d.	A qualified NO	11.5%	30.2%
e.	A definite NO	18.7%	

The number of respondents indicating a willingness to participate in MMEP conducted using prerecorded video cassettes is clearly larger than those not willing to participate.

The cross-tabulation (Table 23) of this question with enrollment status also indicates the support for this alternative. Of the currently enrolled students and graduates, 55.6 percent responded with a definite or qualified YES to the question dealing with participation using prerecorded video cassettes. Only 33.4 percent responded with a qualified or definite NO. Of the non-enrollees, 52 percent answered with a definite or qualified YES, while only 26.4 percent answered with a qualified or definite NO. Strong support for the prerecorded video cassette alternative appears to exist among the respondents. This support could result in a net increase in the enrollment in the MMEP, if this alternative were employed.

The favorable response to this alternative could indicate that the respondents desire to have some additional activity to fill the empty hours of an alert. The reduction in the number of off-duty hours currently spent

TABLE 23

CROSS-TABULATION OF ENROLLMENT STATUS AND MCCM WILLINGNESS TO PARTICIPATE IN THE MMEP USING PRERECORDED VIDEO CASSETTES

	Would be willing to participate in the MMEP if prerecorded video cassettes were used				
	A definite YES	A qualified YES	Neutral/ Undecided	A qualified NO	A definite NO
Graduate or Currently Enrolled	24.2%	31.4% (55.6%)*	11.1%	13.1%	20.3% (33.4%)
Not Currently Enrolled	24.0%	28.0% (52.0%)	21.6%	9.6%	16.8% (26.4)

*Values in parentheses are sums of values above them.

in the MMEP could also be a factor in why the respondents support the use of prerecorded video cassettes.

The alternative of using visiting professors from AFIT's resident schools was the final alternative presented in the questionnaire. The following question was used to determine MCCM attitudes toward the alternative.

> Would you participate in MMEP in which a substantial portion of the classroom instruction was conducted by visiting AF and civil service professors from the resident schools at AFIT?

The responses to this question were as follows:

a.	A definite YES	23.7%	55.4%
b.	A qualified YES	31.7%	
c.	Neutral/Undecided	24.8%	
d.	A qualified NO	10.8%	19.8%
e.	A definite NO	9.0%	

The percentage of respondents indicating a willingness to participate in MMEP using this alternative is clearly greater than those not willing to participate.

The cross-tabulation (Table 24) of this question with enrollment status appears to indicate that this alternative would have the greatest impact on the MMEP enrollment. Of the current enrollees and graduates, 66.7 percent answered a definite or qualified YES when asked if they would participate in the MMEP if visiting professors from AFIT were instructing the class. Of the non-enrollees, 41.6 percent indicated they would participate in the MMEP if visiting professors were instructing the courses. Only 20.8 percent of the non-enrollees remained uninterested in the MMEP. There is, however, a larger percentage, 37.6 percent, of the non-enrollees in the neutral/undecided category.

The large number of respondents willing to participate in MMEP if visiting professors from AFIT resident schools taught the courses might be explained in a couple of ways. First, if respondents placed a high value on having actual face-to-face contact with and access to the instructor, this was the only alternative presented that was capable of meeting this need. Second, the respondents may hold the perception that the resident professors from AFIT have a higher worth than the professors from the local universities. This higher worth may result from the

TABLE 24

CROSS-TABULATION OF ENROLLMENT STATUS AND MCCM WILLINGNESS TO PARTICIPATE IN THE MMEP USING VISITING AF AND CIVIL SERVICE PROFESSORS FROM THE RESIDENT SCHOOL AT AFIT

	Would be willing to participate in MMEP if visiting professors were used				
	A definite YES	A qualified YES	Neutral/ Undecided	A qualified NO	A definite NO
Graduate or Currently Enrolled	29.4%	37.3% (66.7%)*	14.4%	11.1% (18.9%)	7.8%
Not Currently Enrolled	16.8%	24.8% (41.6%)	37.6%	10.4% (20.8%)	9.6%

*Values in parentheses are sums of the values above them.

feeling that the education could be of more value if the program were more closely related to an Air Force resident school.

Summary of Objective One Analysis

Table 25 summarizes the responses to four questions dealing with the respondents' willingness to participate in the MMEP if teleteach, closed-circuit television, pre-recorded video cassettes, or visiting professors were used to present the material.

Based on the combined YES answers, the largest percentage of respondents would be willing to participate

TABLE 25

SUMMARY OF ALTERNATIVE PRESENTATION TECHNOLOGIES

	Willingness to participate				
	A definite YES	A qualified YES	Neutral/ Undecided	A qualified NO	A definite NO
Teleteach	17.3%	24.1% (41.4%)*	27.3%	14.7%	16.5% (31.2%)
Closed-Circuit Television	11.9%	24.8% (36.7%)	23.4%	19.1%	20.9% (40.0%)
Prerecorded Video Cassette	24.1%	29.9% (54.0%)	15.8%	11.5%	18.7% (30.2%)
Visiting Professors	23.7%	33.7% (55.4%)	24.8%	10.8%	9.0% (19.8%)

*Values in parentheses are sums of the values above them.

in the MMEP conducted by visiting professors from AFIT's resident schools. This alternative and the alternative of prerecorded video cassettes both appear to be acceptable to the majority of MCCMs. Additionally the cross-tabulation of these two alternatives with the enrollment status of the respondents indicates that these alternatives may very well increase participation in the MMEP. These alternatives appear to be capable of motivating current non-enrollees to enroll.

The alternative of closed-circuit television appears to be not well supported by the MCCMs. Furthermore, when cross-tabulated with enrollment status, this alternative appears to have the potential of driving currently enrolled students out of the program.

The percentage of respondents willing to participate in MMEP using teleteach is less than a majority. This alternative, however, did have a large percentage of respondents selecting the neutral/undecided answer. Because of the unfamiliarity with the teleteach alternative, a more in-depth explanation of teleteach could greatly affect the respondent's atitude about this alternative. The cross-tabulation of the teleteach alternative with enrollment status also indicates a great deal of uncertainty about this alternative. Among current enrollees and graduates, 47.7 percent would continue to participate while 30 percent indicated they would not participate. The remaining 25.3 percent were neutral/undecided. The non-enrollees were equally split between participation (33.6 percent), neutral/undecided (33.6 percent), and non-participation (32.8 percent).

Analysis of Objective Two

This objective addressed MCCM attitudes toward the curriculum available through MMEP. Several curriculums were offered as alternatives to the MBA. These alternatives were identified in the following question:

Would the MMEP be (or have been) more attractive to you if the curriculum had been centered around any one of the following academic specialties that have been identified as having a large current and projected shortage within the Air Force?

1. Data Processing
2. Telecommunications
3. Special facilities management
4. Engineering management
5. Logistics management
6. Public relations
7. Electronic Engineering
8. Criminology

The responses to this question were as follows:

a.	A definite YES	46.8%	69.1%
b.	A qualified YES	22.3%	
c.	Neutral/Undecided	11.5%	
d.	A qualified NO	8.6%	19.4%
e.	A definite NO	10.8%	

The combined YES answers for this question clearly indicate that the respondents would support an alternative curriculum. In fact, the great positive response could indicate a dislike for the MBA.

A cross-tabulation (Table 26) of this question with enrollment status indicates that the alternative curriculums could greatly increase enrollment. Of the non-enrolled respondents, 77.6 percent indicated MMEP would have been more attractive had one of the alternative curriculums been available. Of the enrollees, 62.1 percent answered a definite or qualified YES, 13.7 percent were neutral/ undecided, and 24.2 percent answered either a qualified or definite NO.

TABLE 26

CROSS-TABULATION OF ENROLLMENT STATUS AND MCCM DESIRE FOR AN ALTERNATIVE CURRICULUM

	Would MMEP have been more attractive had an alternative curriculum been available?				
	A definite YES	A qualified YES	Neutral/ Undecided	A qualified NO	A definite NO
Graduate or Currently Enrolled	39.2%	22.9% (62.1%)*	13.7%	13.1%	11.1% (24.2%)
Not Currently Enrolled	56.0%	21.6% (77.6%)	8.8%	3.2%	10.4% (13.6%)

*Values in parentheses are sums of values above them.

The willingness of the respondents to participate if an alternative curriculum were available is also supported by the responses to the following question:

> Would you be in favor of seeing the current MMEP curriculum replaced with alternative academic specialties identified in Question 37?

(The question with the list of alternative curriculums was question 37 of the questionnaire.) The responses to this question were as follows:

a.	A definite YES	39.6%	63.3%
b.	A qualified YES	23.7%	
c.	Neutral/Undecided	18.3%	
d.	A qualified NO	11.2%	18.4%
e.	A definite NO	7.2%	

Again, the strong response indicates that the MCCMs would support the MMEP if alternative curriculum were available.

The cross-tabulation (Table 27) of this question with enrollment status adds further support toward the apparent dislike for the MBA, at least among the non-enrollees. Seventy-seven point six (77.6 percent) of the non-enrollees answered either a definite or qualified YES in favor of replacing the MBA with an alternative curriculum. Of the enrollees, 51.6 percent answered a definite or qualified YES, 20.9 percent were neutral/undecided, and 27.4 percent answered a qualified or definite NO. It appears that if an alternative curriculum(s) were available, a large number of non-enrollees would be motivated to participate in the MMEP.

The MMEP only offers graduate degrees. However, a great need for junior engineers exists in the USAF. The following question attempted to determine the willingness of MCCMs to pursue an undergraduate degree.

> If available via the MMEP, would you have participated in a program leading to an undergraduate degree in engineering?

The responses to this question were as follows:

a.	A definite YES	28.4%	52.5%
b.	A qualified YES	24.1%	
c.	Neutral/undecided	13.7%	
d.	A qualified NO	12.6%	33.8%
e.	A definite NO	21.2%	

TABLE 27

CROSS-TABULATION OF ENROLLMENT STATUS AND MCCM PREFERENCE FOR AN ALTERNATIVE CURRICULUM

	Would prefer an alternative curriculum				
	A definite YES	A qualified YES	Neutral/ Undecided	A qualified NO	A definite NO
Graduate or Currently Enrolled	25.5% (51.6%)*	26.1%	20.9%	16.3% (27.4%)	11.1%
Not Enrolled	56.8% (77.6%)	20.8%	15.2%	4.8% (7.2%)	2.4%

*Values in parenthesis are sums of values above them.

While these responses do not indicate the same degree of support that appears to exist for different graduate curriculums, the majority of the respondents indicated that they would enroll in a program leading to an undergraduate engineering degree.

The cross-tabulation (Table 28) of this question with enrollment status, shows that 48 percent of the non-enrollees responded with a definite or qualified YES to this question, while 40 percent responded with a qualified or definite NO. Of the enrollees, 56.2 percent indicated they would participate in a program leading to an undergraduate degree in engineering. Overall, 52.2 percent of the respondents indicated a willingness to

TABLE 28

CROSS-TABULATION OF ENROLLMENT STATUS AND MCCM WILLINGNESS TO PARTICIPATE IN THE MMEP LEADING TO AN UNDERGRADUATE DEGREE IN ENGINEERING

	Would be willing to participate in the MMEP if an undergraduate engineering degree were available				
	A definite YES	A qualified YES	Neutral/ Undecided	A qualified NO	A definite NO
Graduate or Currently Enrolled	30.7%	25.5% (56.2%)*	15.0%	13.1%	15.7% (28.8%)
Not Enrolled	25.6%	22.4% (48.0%)	12.0%	12.0%	28.0% (30.0%)

*Values in parentheses are sums of values above them.

participate in an undergraduate engineering program. This large percentage of respondents willing to pursue an engineering degree appears to be an untapped source of potential engineers.

Summary of Objective Two Analysis

The responses to the two questions dealing with alternative graduate curriculum indicate that there may be a considerable increase in participation in the MMEP if a curriculum other than the MBA were offered. The responses to the question dealing with the undergraduate engineering

program indicate there exists a pool of officers interested in becoming engineers.

Survey Analysis Summary

Of the four alternative methods for presenting MMEP, closed-circuit television would not receive a sufficient amount of participation to maintain a viable program. The option of teleteach is in a questionable area, but should not be eliminated due to the large amount of neutral/ undecided answers. The alternatives of prerecorded video cassettes and visiting professors from AFIT resident schools would apparently receive enough MCCM support to be feasible alternatives.

The survey also indicates considerable support for a curriculum other than the current MBA. Graduate programs or an undergraduate engineering degree would be supported by the MCCMs. It appears that if one of the alternative methods of presentation could be used to offer the alternative curriculum, the Air Force needs for certain academic specialties could better be met.

Chapter Summary

The analysis of the cost of alternative teleteach systems indicates that there is a great range of costs associated with the different types of equipment. The costs range from the relative inexpensive Darome

Teleconferencing System to the more expensive AT&T Electronic Blackboard.

Future teleteach systems seem to be oriented toward the ability to introduce computer graphics and other inputs to the network. Presently, satellite transmission capability is extremely expensive, as is two-way closed-circuit television.

Many universities are currently using teleteach technologies to achieve their particular goals. Many different types of teleteach systems are in use. There are numerous types of educational programs ranging from continuing education courses to accredited graduate degrees. Accreditation does not seem to be a problem simply because of the use of teleteach technologies.

The following is a summary of the major disadvantages involved in the use of teleteach technologies:

1. Instructors must prepare a more precise lesson plan for use in the teleteach environment.

2. There is less flexibility for instructor to make last-minute changes to the lesson plans.

3. It is more difficult to establish and maintain group discussions.

4. Some individuals feel that there is a great need for face-to-face contact between instructor and student.

5. Initial reactions to the teleteach environment are extremely negative.

6. Group cohesiveness is difficult to establish and maintain.

7. It is difficult to maintain student attention span for the length of the class.

8. Often it is necessary to coordinate with many different telephone companies.

9. Some of the teleteach equipment is highly sensitive.

10. Required laboratory work is not possible via teleteach technologies.

11. There is considerable lead time involved in developing new lesson plans for use in the teleteach environment.

12. Mechanical problems at one location can delay the entire network.

The following are some of the major advantages resulting from the use of the teleteach technologies:

1. The cost of operating teleteach systems is generally quite low.

2. Teleteach can offer a greatly expanded number of students the opportunity to participate in some educational experience.

3. The electronic blackboard, teleconferencing systems, and audio-visual tapes are highly reliable.

4. Teleteach technologies can be used in a variety of programs ranging from continuing education to graduate degrees in nuclear engineering.

5. Because lesson plans must be developed well in advance, they tend to be better.

6. Taped teleteach class sessions can be replayed many times and at the convenience of the students.

7. Considerable savings in travel expenses can be realized.

8. Teleteach programs do not require students to be uprooted from their normal environment.

The current administration at AFIT tends to agree that teleteach technologies can be employed to meet the objectives of the institute. Due to a perceived loss of quality in education, there seems to be doubt about the effectiveness of an MMEP taught solely by the use of teleteach technologies. There is, however, a noticeable difference of opinion on this matter.

The analysis of the MCCM survey tends to indicate that MCCMs are willing to participate in a MMEP conducted by an alternative method. Teleteach technologies may be acceptable to the MCCMs. MCCMs also indicated a desire for a curriculum other than the MBA currently being awarded in the MMEP.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

Introduction

This chapter states the findings and conclusions relevant to the achievement of the stated research objectives. Our proposed actions for SAC and AFIT with respect to the MMEP are also stated as are recommended areas of future research.

Objectives and Findings

The primary objective of this research was the investigation and evaluation of factors that would impact on the use of teleteach technologies in the MMEP. To accomplish this objective, four sub-objectives were investigated.

Sub-objective One

Sub-objective one was to identify equipment currently available for use in a teleteach program. Many innovations have occurred since the early use of the simple telephone in teleteach programs. Many telephone line terminal devices are available for use in today's classrooms. Graphics tablets and electronic blackboards are the current state-of-the-art. With these devices, however, only written material can be transmitted.

Slow scan television can send pictures over telephone lines; however, current speeds and resolutions are not ideal for classroom environments. Future developments in slow scan TV may improve this situation. Future developments in graphic tablets appear to be near. Multiple inputs, such as computer-controlled graphics, could greatly increase the capabilities of the graphics tablets. Finally, reductions in the cost of satellite transmission capabilities could open that area for use by a teleteach MMEP.

Sub-objective Two

Sub-objective two was to identify the costs of the available equipment and compare this cost to the current MMEP. A cost comparison between a teleteach system based on the electronic blackboard and the current MMEP was conducted. It appears that teleteach could reduce the cost of the MMEP substantially.

Sub-objective Three

Sub-objective three was to ascertain if a teleteach MMEP could more adequately meet the Air Force needs for advanced academic degrees. With the exception of curriculums that require many hours of laboratory work, this research has shown that teleteach is not the limiting factor in the determination of the type of curriculum that can be offered via teleteach. The limitation lies in what is available at the originating school.

The Air Force demands a large number of engineers and AFIT has an expertise in these areas. Exportation of these programs, however, would face many barriers because of the laboratory requirements and concerns about the reduced quality of the education. This leaves only curriculums in the School of Systems and Logistics (LS). It appears that programs from LS could be exported easily. This, however, would not solve the overall problem of shortages in certain academic areas. In a short time there would be an oversupply of logisticians, but there would still be shortages in other areas.

The use of AFIT as the school of origin for a teleteach MMEP would not have a significant impact in many of the areas where the Air Force is faced with academic shortages. AFIT does not have the in-house capability to offset these shortages.

Sub-objective Four

Sub-objective four was to identify the impact on the academic standards required by AFIT and the MMEP. This research indicates that there are not any significant academic drawbacks to the use of the teleteach technologies. Many schools are conducting accredited graduate programs via teleteach. The technology is a sound delivery method and accreditation should present no special problems.

Recommendations for AFIT and SAC

AFIT and SAC should carefully examine the use of teleteach as a means of conducting the MMEP. Teleteach MMEP could be an excellent compromise between the cost of the current MMEP and complete elimination of the MMEP. As indicated in Chapter IV, the teleteach MMEP could be implemented at a substantial savings.

A recommended program would be a mix of conventional and teleteach instruction. Professors resident at the missile wing AFIT detachments should be able to instruct in areas that are not particularly suitable to teleteach instruction. The courses highly suitable to teleteach delivery (statistics, mathematics, and other quantitative courses) could be taught from AFIT. Access to AFIT via a teleteach network would augment the instructors resident at the detachments and would provide sufficient variety of courses to allow completion of the programs currently available at LS.

Access to AFIT would also make it possible to offer MCCMs the opportunity to take non-laboratory engineering courses. This would allow MCCMs interested in pursuing an engineering degree to complete a portion of certain courses while still on crew. They could then apply for a follow-on assignment in-residence at AFIT.

It appears that it would be feasible to initiate this program on a test basis. This could be accomplished by establishing a teleteach network between AFIT and any one of the six missile wing AFIT detachments. If the test program proved acceptable to SAC and the MCCMs, the network could easily be expanded to include the other missile wings.

Furthermore, the total network could easily expand as AFIT's teleteach capabilities expand. For example, the use of video cassettes is an alternative currently being considered by AFIT that would be ideal for use in MMEP. MCCMs indicated in the MCCM survey that this alternative was highly attractive.

Recommendations for Future Research

An area of concern in terminating the current MMEP deals with the impact on current enrollees and the universities currently contracted to conduct the MMEP. The analysis of these impacts is an area of future research.

The problems of scheduling MCCMs for a teleteach MMEP were not considered. The use of teleteach at all six missile wings would require simultaneous scheduling of a portion of the entire missile combat crew force. The impact of this should be considered well in advance.

Finally, this thesis did not consider the time element. A complete time-phased schedule for implementing the teleteach MMEP would have to be accomplished.

APPENDICES

APPENDIX A

LIST OF COMPANIES CONTACTED

AT&T

RCA

Satellite Communications Company

Darome, Inc.

Talos

RCA Satellite Company

Western Union Satellite Company

Colorado Video, Inc.

Infolink Corporation

APPENDIX B

QUESTIONS ADDRESSED TO SALES REPRESENTATIVES

1. What type of equipment is presently available to be utilized in a teleteach system?

2. What type of connecting media are in use for long-distance communications? Why? What is the cost?

3. Do you perceive that satellites will play a greater part in the teleteach system network?

4. What is the buying and/or leasing cost for each component?

5. What is the installation cost for each component?

6. What should each station consist of?

7. What are the minimum criteria or requirements that are to be present in each classroom?

8. How long can your system be used continuously without interruption for maintenance?

9. What problems do you perceive to be in providing maintenance to the following Air Force bases? Malmstrom AFB, Great Falls, MT; Ellsworth AFB, Rapid City, SD; Minot AFB, Minot, ND: Whiteman AFB, Knob Noster, MO; F. E. Warren AFB, Cheyenne WY; and Grand Forks AFB, Grand Forks, ND.

10. What schools and/or universities are presently using your system?

APPENDIX C

QUESTIONS ADDRESSED TO PROFESSORS/ADMINISTRATORS

1. How long have you been using the teleteach system?

2. What are the major problems with this type of system?

3. How many point of origins and remote locations are in your teleteach network?

4. Does it take longer to prepare a lesson plan for a teleteach class? How much?

5. Are there any problems in accreditation of the teleteach courses?

6. How much support equipment, slide projector, overhead projectors, screens, etc., are required for the teleteach system?

7. How many people would you say are required to support your teleteach system?

8. Compare the costs of teleteach versus conventional instruction on a student per hour basis.

9. How reliable is your system?

10. Describe the equipment used in teleteach system.

11. List three major drawbacks to the use of teleteach.

12. List three major advantages of the teleteach system.

13. How would you change your teleteach system?

APPENDIX D

QUESTIONS ADDRESSED TO GENERAL COOKE, COLONEL ISRAELITT, DR. PRZEMIENIECKI AND DR. FAIMAN

1. Do you think that teleteach has the capability of providing graduate degrees in those areas which the Air Force has evidence of shortages? and how?

2. Do you see any advantages in a teleteach system to be utilized in the MMEP?

3. Do you see any disadvantages in a teleteach system to be utilized in the MMEP?

4. Do you think that the faculty will be willing to instruct the MMEP using the teleteach system?

5. Do you think that there are any problems in accrediting the teleteach courses?

APPENDIX E

MCCM SURVEY QUESTIONS

A potential method of providing a variety of graduate courses in the MMEP is through the use of a teleteach system. This system utilizes a combination of telephones to transmit educational materials from the transmitting facility to another location.

There are basically two types of teleteach systems. One uses an electronic blackboard; a device which enables the transmission of static pictorial and diagrammatic materials over the telephone lines. With this system the student never sees the instructor but does see everything the instructor writes on the chalkboard. Students also have two-way communications with the instructor. This teleteach system is quite different from closed circuit TV (CCTV) because of these two factors: the electronic chalkboard, and real time two-way dialogue between the student and the instructor. This system also uses 35mm slides to augment the electronic chalkboard. The other teleteach system is basically a CCTV system. The students see the instructor but have no two-way communications with that person.

1. Would you participate in MMEP if a substantial portion of the classroom instruction originated elsewhere but was brought to your classroom in real time via audio-visual telecommunications equipment?

a. A definite yes
b. A qualified yes
c. Neutral/undecided
d. A qualified no
e. A definite no

2. Would you participate in a MMEP in which closed circuit television was utilized in presenting course material in your classroom?

a. A definite yes
b. A qualified yes
c. Neutral/undecided
d. A qualified no
e. A definite no

3. Would you participate in a MMEP in which a substantial portion of the classroom instruction was prerecorded on video cassettes which could be transported to the launch control center?

a. A definite yes
b. A qualified yes
c. Neutral/undecided
d. A qualified no
e. A definite no

4. Would you participate in a MMEP in which a substantial portion of the classroom instruction was conducted by visiting AF and civil service professors from the resident schools at AFIT?

a. A definite yes
b. A qualified yes
c. Neutral/undecided
d. A qualified no
e. A definite no

5. Would the MMEP be (or have been) more attractive to you if the curriculum had been centered around any one of the following academic specialties that have been identified as having current and projected shortages within the Air Force:

1. Data processing
2. Telecommunications
3. Special facilities management
4. Engineering management
5. Logistics management
6. Public relations
7. Crimonology

a. A definite yes
b. A qualified yes
c. Neutral/undecided
d. A qualified no
e. A definite no

6. Would you be in favor of seeing the current MMEP curriculum replaced with alternate academic specialties identified in the above question?

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